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A Voice for the Fish - Climate Change Litigation and Potential Causes of Action for Impacts under the United Nations Fish Stocks Agreement

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A VOICE FOR THE FISH? CLIMATE CHANGE LITIGATION AND POTENTIAL CAUSES OF ACTION FOR IMPACTS UNDER THE UNITED NATIONS FISH STOCKS AGREEMENT

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The seas—all the seas—cry for regulation as a veritable *res communis omnium*.[1]

I. INTRODUCTION

Climate change litigation has been transformed from a creative lawyering strategy to a major force in transnational regulatory governance of greenhouse gas emissions over the last couple of years. Several actions related to climate change have been initiated in national courts and regulatory agencies in several countries,[2] as well as two actions in

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1. Louis Henkin, *Arctic Anti-Pollution: Does Canada Make—or Break—International Law?*, 65 AM. J. INT'L L. 131, 136 (1971).

2. Actions have been brought in U.S. courts, *inter alia*, under the Clean Air Act, the National Environmental Policy Act, and common law nuisance theories, as well as agency action under the Endangered Species Act. This includes the Supreme Court's recent decision in *Massachusetts v. EPA*, 127 S. Ct. 1438 (2007), *rev'g*, 415 F.3d 50 (D.C. Cir. 2007). In Massachusetts v. EPA, twelve states and several cities and nongovernmental organizations filed an action against the U.S. Environmental Protection Agency (EPA), challenging its denial of a petition to regulate greenhouse gas emissions from new motor vehicles under section 202(a)(1) of the Clean Air Act. *See id.* at 1446. The U.S. Supreme Court held for the plaintiffs, concluding that the EPA had authority to regulate such emissions and that the agency must ground its reason for action or inaction in the terms of the Act. *See id.* at 1463. For excellent overviews of U.S. actions to date see Michael B. Gerrard, *Survey of Climate Change Litigation*, 283(63) N.Y.L.J. 1-2 (2007); JUSTIN R. PIDOT, GLOBAL WARMING IN THE COURTS 1-22 (2006), http://www.law.georgetown.edu/gelpi/current_research/documents/GlobalWarmingLit_CourtsReport.pdf. Actions have also been brought in German, Canadian, Australian, and Nigerian courts. For a summary of these cases, consult the

international fora: the Inter-American Commission on Human Rights[3] and the World Heritage Committee.[4]

Climate Justice website, http://www.climatelaw.org.

3. In December of 2005, the Inuit people of Canada and Alaska filed a petition against the United States before the Inter-American Commission on Human Rights. *See* Inuit Circumpolar Council, Petition to the Inter-American Commission on Human Rights Seeking Relief from Violations Resulting from Global Warming Caused by Acts and Omissions of the United States, http://www.inuitcircumpolar.com/files/uploads/icc-files/FINALPetitionICC.pdf (last visited Mar.. 23, 2008). The petition contends that the impacts of climate change on the Inuit people caused by acts and omissions of the United States in failing to meet its international legal obligations to not cause transboundary harm, as well as violation of treaty obligations under the UNFCCC and other agreements, violate the human rights of the Inuit people. The petition calls on the Commission to prepare a report recommending that the United States, *inter alia*: Adopt mandatory measures to limit its greenhouse gas emissions; Take into account the impact of U.S. greenhouse gas emissions on Arctic and Inuit before approving major government policies; Establish a plan to protect Inuit culture and resources. *See* Inuit Circumpolar Council, Summary of the Petition, http://www.inuitcircumpolar.com/files/uploads/icc-files/FINALPetitionSummary.pdf (last visited Mar. 23, 2008). In December 2006, the Inter-American Commission declined to rule on the petition. Letter from Ariel E. Dulitzky, Assistant Executive Sec'y, Organization of American States, to Paul Crowley, Legal Rep. (Nov. 16, 2006), *available at* http://graphics8.nytimes.com/packages/pdf/science/16commissionletter.pdf (last visited on Mar. 23, 2008)

4. *See* Environmental Law Alliance Worldwide, Urge UNESCO to Review Climate Change Petitions, http://www.elaw.org/campaigns/info.asp?id=2929 (last visited July 3, 2005). Between 2004-2006, non-governmental organizations from several countries filed petitions with the World Heritage Committee to protect five sites that are classified as World Heritage sites under the Convention Concerning the Protection of the World Cultural and Natural Heritage, T.I.A.S. No. 8226, 11 I.L.M. 1358 (1972) [hereinafter World Heritage Convention]: the Belize Barrier Reef Reserve System, the Huarascán National Park in Peru, the Sagarmatha National Park in Nepal, the Great Barrier Reef in Australia and Waterton-Glacier International Peace Park in the United States and Canada. The respective petitions requested that the World Heritage Committee designate these sites as "In Danger" under Article 11(4) of the Convention as a consequence of the threat posed by climate change. See petitions at: http://www.climatelaw.org/cases/topic/unesco/ (last visited on Mar. 23, 2008). The listing of a site under Article 11(4) mandates the development of a "programme of corrective action." *See* WORLD HERITAGE COMM., OPERATIONAL GUIDELINES FOR THE IMPLEMENTATION OF THE WORLD HERITAGE CONVENTION, § 186 (2005), http://whc.unesco.org/archive/opguide05-en.pdf. The petitioners requested, *inter alia*, that the corrective measures include greenhouse gas reduction measures by major greenhouse gas emitting Parties. *See* Belize Inst. of Envtl. Law & Policy, Petition to the World Heritage Committee Requesting Inclusion of Belize Barrier Reserve System in the List of World Heritage in Danger as a Result of Climate Change and for Protective Measures and Actions, at 30 Nov. 15, 2004), http://www.climatelaw.org/cases/case-documents/unesco/belize-petition.doc; Forum for Prot. of Pub. Interest, Petition to the World Heritage Committee Requesting Inclusion of the Huascaran National Park in the List of World

This article examines another potential international forum in which the threat of climate change might be addressed: The Agreement for the Implementation of the Provisions of the U.N. Convention on the Law of the Sea 10 Dec. 1982 Relating to the Conservation and Management of Straddling Fish Stocks and High Migratory Fish Stocks (UNFSA).[5] Actions under UNFSA could be salutary for several reasons. First, the commercial fisheries sector may be profoundly and adversely affected by climate change.[6] This includes many fish stocks regulated under UNFSA: highly migratory species, which have wide geographic distribution and undertake significant migrations,[7] and straddling stocks,

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Heritage in Danger as a Result of Climate Change, at 41 (Nov. 17, 2004), http://www.climatelaw.org/cases/case-documents/unesco/peru-petition.doc. The World Heritage Committee considered the petitions at its twenty-ninth session in Durban, South Africa in July 2005. It requested that the regime's World Heritage Centre establish a working group of experts, including the petitioners, to review the nature and scales of risks to World Heritage sites associated with climate change and to develop a strategy to assist the Convention's Parties to implement appropriate management responses. The working group was tasked with reporting back at the thirtieth session in 2006. At its thirtieth session, the Committee decided not to list the sites listed in the petitions as "in Danger," and also rejected a request to encourage the Parties to draw on projections from the Intergovernmental Panel on Climate Change when assessing risks to World Heritage Sites. *See Heritage Body "No" to Carbon Cuts*, BBC NEWS, July 10, 2006, http://news.bbc.co.uk/2/hi/science/nature/5164476.stm. The Committee did, however, adopt a "Strategy to Assist States Parties to Implement Appropriate Management Responses" to climate change and urged the Parties to the World Heritage Convention to implement the Strategy. Moreover, the Committee decided that World Heritage sites could be inscribed on the List of World Heritage in Danger on a case-by-case basis, but also called for a study on alternatives to such listings. *See* UNESCO World Heritage Centre, *World Heritage Committee Adopts Strategy on Heritage and Climate Change*, Jul. 10, 2006, http://whc.unesco.org/en/news/262.

5. United Nations Conference on Straddling Fish Stocks and Highly Migratory Fish Stocks, July 24 – Aug. 4, 1995, *Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks*.

6. *See infra* Part A.

7. *See* Pacific Fishery Management Council, Background: Highly Migratory Species (2005), http://www.pcouncil.org/hms/hmsback.html. Highly migratory species include many species of tuna and tuna-like species, oceanic sharks, mackerel, sauries, pomfrets, swordfish, marlin, and sailfish. *See* S.M. GARCIA, WORLD REVIEW OF HIGHLY MIGRATORY SPECIES AND STRADDLING STOCKS, UN FOOD AND AGRICULTURE ORGANIZATION, FAO FISHERIES TECHNICAL PAPER NO. 337 (1994), http://www.fao.org/docrep/003/T3740E/T3740E00.htm; NOAA Fisheries Office of Sustainable Fisheries, Highly Migratory Species, http://www.nmfs.noaa.gov/sfa/hms/ (last visited Feb. 16, 2008).

which occur both within and beyond Exclusive Economic Zones (EEZs).[8] Overall, "[m]igratory and straddling species account for roughly 20 percent of the total marine catch and include some of the most economically valuable fish populations."[9]

Second, the United States, one of the world's largest emitters of greenhouse gases[10] and a State with an abject record in addressing climate change, was one of the first nations to ratify UNFSA,[11] and has played an active leadership role in its implementation.[12] UNFSA thus presents an excellent forum in which to engage the United States and other major greenhouse gas emitters, including the European Union and China, on climate issues. Finally, unlike the other international fora where climate change actions have been pursued to date, UNFSA provides a dispute resolution mechanism with teeth.[13]

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8. *See* GARCIA, *supra* note 7. Overall, about 200 species have been identified as highly migratory species or straddling stocks species. *See* FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, THE STATE OF WORLD HIGHLY MIGRATORY STRADDLING AND OTHER HIGH SEAS FISHERY RESOURCES AND ASSOCIATED SPECIES 2, FAO FISHERIES TECHNICAL PAPER NO. 495 (2006), ftp://ftp.fao.org/docrep/fao/009/a0653e/A0653E01.pdf. "Most typically, such stocks frequent the localized edges of wide continental shelves, e.g., the 'Flemish Cap' in the northwest Atlantic, or the continental slopes . . . ." Jamison E. Colburn, *Turbot Wars, Straddling Stocks, Regime Theory, and a New U.N. Agreement*, 6 J. TRANSNAT'L L. & POL'Y 323, 327 (1997).

9. W.M. von Zharen, *The Shrinking Sea and Expanding Sovereignty: The Fate of Fisheries*, 15 NAT. RESOURCES & ENV'T 24, 26 (2000).

10. In 2006, China's greenhouse gas emissions surpassed those of the United States. *See* Press Release, Netherlands Environmental Assessment Agency, Chinese CO2 in Perspective (June 22, 2007), http://www.mnp.nl/en/service/pressreleases/2007/20070622ChineseCO2emissionsinperspective.html. However, the United States is still responsible for approximately a quarter of the world's cumulative greenhouse gas emissions over the past century. *See* Kevin A. Baumert & Nancy Kete, *Climate Issue Brief*, World Resources Institute, at 1 (2001). Additionally, U.S. per capita emissions are approximately ten times those of China. *See id.* at 2.

11. *See* Note, *Fisheries: United States Ratifies Agreement on Highly Migratory and Straddling Stocks*, 8 COLO. J. INT'L ENVTL. L. & POL'Y 78, 80 (1996).

12. David A. Balton & Holly R. Koehler, *Reviewing the United Nations Fish Stocks Treaty*, 6 SUSTAINABLE DEV. L. & POL'Y 5, 5-6 (2006), *available at* http://www.wcl.american.edu/org/sustainabledevelopment/2006/06fall.pdf?rd=1.

13. *See infra sec.* D.2. By contrast, under the American Convention on the Rights of Man, which is invoked in the Inuit's petition to the Inter-American Commission on Human Rights, the Inter-American Commission's only recourse, should it find the United States to have violated the human rights of the Inuit, is to issue a report outlining conclusions and non-binding recommendations.

An article of this length necessarily cannot discuss all of the intricate scientific and legal issues that an action of this nature would invoke; rather it seeks to lay a foundation for further research and discussion. In this pursuit this article will: 1) Provide an overview of climate change science; 2) Examine the exigency that has spurred climate change litigation: the inadequacy of international and national responses to climate change; 3) Outline the potential impacts of climate change on fish species, with an emphasis on the potential impacts on highly migratory fish species and straddling stocks; 4) Provide an overview of UNFSA and potential actions for climate change damages under the Agreement; and 5) Briefly discuss potential barriers to such actions.

A. Overview of Climate Change Science

The most recent assessment by the Intergovernmental Panel on Climate Change (IPCC)[14] concluded that average global surface temperatures have increased by 0.76°C since 1850, with the linear warming trend over the past fifty years

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See Inter-American Commission on Human Rights, What is the IACHR?, http://www.cidh.org/what.htm (last visited Feb. 16, 2008). Because the United States is not a member of the Inter-American Court on Human Rights, the Commission cannot refer the case to the Court for a binding decision. *See id.* Similarly, even if the World Heritage Convention were to list World Heritage sites threatened by climate change on its "in danger" list in the future, this would trigger little more than the potential for financial assistance to address the threats under the Convention. *See* WORLD HERITAGE CONVENTION, *supra* note 4, at 11(4).

14. The IPCC was established by the World Meteorological Organization and the United Nations Environment Program in 1988 to review and assess the most recent scientific, technical and socio-economic information related to the understanding of climate change, to evaluate proposals for reducing greenhouse gas emissions, and to assess the viability of response mechanisms. *See* G.A. Res. 43/53, U.N. Doc. A/43/49 (Dec. 6, 1988), *available at* http://www.un.org/documents/ga/res/43/a43r053.htm. The IPCC provides comprehensive Assessment Reports of the current knowledge and future projections of climate change at regular intervals. *See generally* IPCC Reports, http://www.ipcc.ch/ipccreports/assessments-reports.htm. The reports are authored by teams of authors from throughout the world from universities, research centers, businesses and non-governmental organizations. *See id.* There were more than 800 contributing authors to the latest report, and more than 2500 scientific expert reviewers of the report. *See id.* The First Assessment Report was published in 1990, the Second Assessment Report in 1995, the Third Assessment Report was released in 2001, and the Fourth Assessment Report (designated as AR4) was in four volumes throughout 2007.

twice that of the past century.[15] Moreover, the assessment concluded that "[m]ost of the observed increase in globally averaged temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic greenhouse gas concentrations."[16] This Section provides an overview of the scientific understanding of the growth and impact of greenhouse gases.

The surface of the Earth is heated by solar radiation emanating from the sun at short wavelengths between 0.15 and 5 μm. Each square meter of the Earth receives an average of 342 watts of solar radiation throughout the year.[17] Approximately 26% of this radiation is reflected or scattered back to space by clouds and other atmospheric particles, and another 19% is absorbed by clouds, gases and atmospheric particles.[18] Fifty-five percent of incoming solar energy passes through the atmosphere. Four percent is reflected from the surface back to space, so 51% reaches the Earth's surface. The heating of Earth's surfaces causes re-radiation of approximately one third of this energy in the form of long-wave band (wavelengths of 3-50 μm), or "infrared," radiation.[19]

Some of the outgoing infrared radiation is absorbed by

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15. *See* IPCC, CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS 5 (2007), *available at* http://www.ipcc.ch/SPM2feb07.pdf. Atmospheric temperatures have been rising at a rate of approximately 0.2°C per decade over the past thirty years. *See* Declaration of James E. Hansen, Green Mountain Chrysler-Plymouth-Dodge-Jeep et al. v. Torti, Nos. 2:05-CV-302 & 2:05-CV-304 (D. Vt. Aug. 14, 2006), *available at* http://www.columbia.edu/~jeh1/case_for_vermont.pdf.

16. IPCC, *supra* note 15, at 10; *see also* Richard Somerville et al., *Historical Overview of Climate Change Science*, *in* CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS. CONTRIBUTION OF WORKING GROUP I TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 105 (S. Solomon et al. eds., 2007), *available at* http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter1.pdf ("[H]uman activities have become a dominant force, and are responsible for most of the warming observed over the past 50 years . . ."). The IPCC defines the term "very likely" as a greater than 90% likelihood of occurrence/outcome. *See id.* at 121.

17. *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2001: THE SCIENTIFIC BASIS, CONTRIBUTION OF WORKING GROUP I TO THE THIRD ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 89 (2001) [hereinafter CLIMATE CHANGE 2001 - SCIENTIFIC].

18. *See* PhysicalGeography.net, The Greenhouse Effect, http://www.physicalgeography.net/fundamentals/7h.html (last visited Feb. 16, 2008).

19. *See* Somerville, *supra* note 16, at 96.

naturally occurring atmospheric gases: principally water vapor (H_2O), but also carbon dioxide (CO_2), ozone (O_3), methane (CH_4), nitrous oxide (N_20), and clouds.[20] This absorption is termed the "natural greenhouse effect" because these gases, which are termed "greenhouse gases," operate much like a greenhouse. They are "transparent" to incoming short-wave radiation, but "opaque" to outgoing infrared radiation, which causes them to trap a substantial portion of such radiation and re-radiate much of this energy to the Earth's surface, thereby increasing surface temperatures.[21] While greenhouse gases comprise only 1% of the atmosphere,[22] they are critical to the sustenance of life on Earth because they elevate surface temperatures by about 33°C.[23]

Prior to the Industrial Revolution, atmospheric concentrations of naturally occurring greenhouse gases had been relatively stable for ten thousand years.[24] As a consequence, the net incoming solar radiation at the top of the atmosphere was roughly balanced by net outgoing infrared radiation.[25] However, with the advent of fossil fuel burning plants to support industry, automobiles, and the energy demands of modern consumers, as well as the substantial expansion of other human activities, including agricultural production, "humans began to interfere seriously in the composition of the atmosphere"[26] by emitting large

20. *See* Thomas R. Karl & Kevin E. Trenberth, *Modern Global Climate Change*, 302 SCI. 1719, 1719 (2003).

21. University of California-San Diego, Climate Change Earth & Science System, *General Effect: The Greenhouse Effect,* http://earthguide.ucsd.edu/virtualmuseum/climatechange1/02_1.shtml (last visited on Mar. 23, 2008).

22. *See* United Nations Framework Convention on Climate Change Secretariat, The Greenhouse Effect and the Carbon Cycle, http://unfccc.int/essential_background/feeling_the_heat/items/2903.php (last visited Feb. 16, 2008).

23. *See id.*

24. *See* Haroon S. Kheshgi, Steven J. Smith & James A. Edmonds, *Emissions and Atmospheric CO_2 Stabilization*, 10 MITIGATION & ADAPTATION STRATEGIES FOR GLOBAL CHANGE 213, 214 (2005).

25. *See* JOHN R. JUSTUS & SUSAN R. FLETCHER, GLOBAL CLIMATE CHANGE, CRS ISSUE BRIEF FOR CONGRESS, IB89005: GLOBAL CLIMATE CHANGE 3 (Aug. 13, 2001), *available at* http://www.ncseonline.org/NLE/CRSreports/Climate/clim-2.cfm?&CFID=13638750&CFTOKEN=63020586.

26. Fred Pearce, *World Lays Odds On Global Catastrophe*, NEW SCIENTIST INT'L, Apr. 8, 1995, at 4.

amounts of additional greenhouse gases. The human-driven buildup of greenhouse gases in the atmosphere has resulted in "radiative forcing." That is, increased levels of greenhouse gases result in greater absorption of outgoing infrared radiation and ultimately an increase in temperatures when a portion of this radiation is re-radiated to the Earth's surface.[27]

The most important anthropogenic greenhouse gas over the past two centuries has been carbon dioxide, which is primarily attributable to fossil fuel combustion,[28] cement production, and land-use change.[29] Carbon dioxide has

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27. *See* UNEP, VITAL CLIMATE CHANGE GRAPHICS 10 (2005), *available at* http://www.vitalgraphics.net/_documents/clmate_change_update.v15.pdf.

> The earth then is radiating less energy to space than it absorbs from the sun. This temporary planetary energy imbalance results in the earth's gradual warming . . . Because of the large capacity of the oceans to absorb heat, it takes the earth about a century to approach a new balance—that if, for it to once again receive the same amount of energy from the sun it radiates to space. And of course the balance is reset at a higher temperature.

James Hansen, *Defusing the Global Warming Time Bomb*, SCI. AM., Mar. 2004, at 71.

28. Consumption of crude oil and coal account for almost 77% of fossil fuel carbon dioxide emissions. *See* CLIMATE CHANGE SCI. PROGRAM & THE SUBCOMM. ON GLOBAL CHANGE RESEARCH, OUR CHANGING PLANET: THE U.S. CLIMATE CHANGE SCIENCE PROGRAM FOR FISCAL 2007, at 117 (2007). Energy-related carbon dioxide emissions have risen 130-fold since 1850. *See* PEW CTR. ON GLOBAL CLIMATE CHANGE, CLIMATE CHANGE 101: UNDERSTANDING AND RESPONDING TO GLOBAL CLIMATE CHANGE 34 (2006), *available at* http://www.pewclimate.org/docUploads/Climate101-FULL_121406_065519.pdf. "Worldwide use of coal, oil, and natural gas in 2005 led to the emission of about 7.5 gigatonnes of carbon (GtC) in CO2, an amount that continues to increase year by year." ROSINA BIERBAUM ET AL., CONFRONTING CLIMATE CHANGE: AVOIDING THE UNMANAGEABLE AND MANAGING THE UNAVOIDABLE, SCIENTIFIC EXPERT GROUP REPORT ON CLIMATE CHANGE AND SUSTAINABLE DEVELOPMENT 12 (2006), http://www.unfoundation.org/files/pdf/2007/SEG_Report.pdf.

29. "The additional release in recent years from deforestation and land-use change, mainly in tropical regions, has been estimated variously at between 0.7 GtC/year and 3.0 GtC/year in CO_2. . . a mid-range value of 1.5 GtC/year is often cited." BIERBAUM ET AL., *supra* note 28, at 12-13. This comprises 20-25% of anthropogenic greenhouse gas emissions. *See* CHATHAM HOUSE ROYAL SOC'Y FOR THE PROTECTION OF BIRDS, WORKSHOP ON REDUCING EMISSIONS FROM TROPICAL DEFORESTATION, SUMMARY REPORT 1 (2007), *available at* http://www.chathamhouse.org.uk/file/9814_160407workshop.pdf; Raymond E. Gullison et al., *Tropical Forests and Climate Change*, 316 SCI. 985, 985 (2007). Deforestation also contributes to warming trends by eliminating possible increased storage of carbon and decreasing evapotranspiration. *See* G. Bala et al., *Combined Climate and Carbon-Cycle Effects of Large-Scale Deforestation*, 104(16) PROC. NAT'L. ACAD. SCIENCES 6550, 6550 (2007). However, deforestation exerts a cooling effect, particularly in seasonally snow-covered

accounted for 90% or more of the increased greenhouse gas climate forcing[30] in recent years.[31] Since 1751, over 297 billion metric tons of carbon have been released into the atmosphere from anthropogenic sources, with half of the emissions occurring since 1978.[32] Atmospheric concentrations of carbon dioxide were approximately 280 parts per million (ppm) at the start of the Industrial Revolution in the 1780s. It took a century and a half to reach atmospheric concentrations of 315 ppm. The trend accelerated in the Twentieth Century, reaching 360 ppm by the 1990s, and 384 ppm currently,[33] which exceeds atmospheric levels for at least the last 650,000 years,[34] and most likely the past twenty million years.[35]

Nitrous oxide emissions, primarily generated through fertilizer production and industrial processes, account for approximately 5% of greenhouse gas forcing in recent years.[36] Atmospheric concentrations of nitrous oxides rose from a value of 270 parts per billion (ppb) prior to the Industrial Revolution to 319 ppb in 2005.[37]

Methane emissions, generated primarily through rice

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high latitudes, by decreasing the albedo (reflectivity) of surfaces. *See id.*

30. The term "forcing" refers to "an imposed change of the planet's energy balance with space." James Hansen et al., *Climate Change and Trace Gases*, 365 PHIL. TRANSACTIONS ROYAL SOC'Y A 1925, 1936 (2007).

31. *See* James Hansen & Makiko Sato, *Greenhouse Gas Growth Rates*, 101(46) PROC. NAT'L. ACAD. SCIENCES 16109, 16111 (2004).

32. *See* CLIMATE CHANGE SCI. PROGRAM & THE SUBCOMM. ON GLOBAL CHANGE RESEARCH, *supra* note 28, at 117.

33. *See* Eric Steig, *The Lag between Temperature and CO_2*, REALCLIMATE, Apr. 27, 2007, *available at* http://www.realclimate.org/index.php?p=430. Approximately half of carbon dioxide emissions since 1751 have occurred since 1978. *See* CLIMATE CHANGE SCI. PROGRAM & THE SUBCOMM. ON GLOBAL CHANGE RESEARCH, *supra* note 28, at 117. Carbon dioxide emissions grew 80% between 1970 and 2004. *See* IPCC, WORKING GROUP III CONTRIBUTION TO THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, FOURTH ASSESSMENT REPORT, CLIMATE CHANGE 2007: MITIGATION OF CLIMATE CHANGE, SUMMARY FOR POLICYMAKERS 3 (2007), http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-spm.pdf [hereinafter MITIGATION OF CLIMATE CHANGE].

34. *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS 4 (2007), http://www.ipcc.ch/SPM2feb07.pdf.

35. *See* CNA CORP., NATIONAL SECURITY AND THE THREAT OF CLIMATE CHANGE 56 (2007), *available at* http://www.securityandclimate.cna.org/report/National%20Security%20and%20the%20Threat%20of%20Climate%20Change.pdf.

36. *See* Hansen & Sato, *supra* note 31, at 16111.

37. *See* IPCC, *supra* note 15, at 4.

cultivation, ruminants, energy production, and landfills, account for approximately 4% of greenhouse gas forcing in recent years.[38] Atmospheric concentrations of methane have increased 153% from pre-Industrial Revolution levels, reaching 1774 ppb in 2005. This far exceeds the natural range of the last 650,000 years.[39] Overall, the global emissions of the six primary anthropogenic greenhouse gases rose 70% between 1970 and 2004.[40]

The increasing emissions translate into tangible human impacts. The World Health Organization has estimated that warming and precipitation trends over the past thirty years associated with anthropogenic climate change have claimed 150,000 lives annually, primarily attributable to human disease and malnutrition.[41] Recent studies have linked the significant increase in violent weather events over the past several decades to increases in sea surface temperature associated with climate change.[42] Other expressions of climate change include "increasing ground instability of permafrost regions . . . shifts in ranges and changes in algal, plankton and fish abundance in high-latitude oceans . . . [and] poleward and upward shifts in ranges in plant and animal species . . . ."[43]

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38. *See* Hansen & Sato, *supra* note 31, at 16111.

39. *See* IPCC, *supra* note 15, at 4. However, methane growth rates have declined since the early 1990s. *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, SUMMARY FOR POLICYMAKERS OF THE SYNTHESIS REPORT OF THE IPCC FOURTH ASSESSMENT REPORT 4 (2007), *available at* http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf. Overall, emissions of the six primary greenhouse gases generated by anthropogenic sources increased 75% between 1970 and 2004. *See* Netherlands Environmental Assessment Agency, *Global Greenhouse Gas Emissions Increased 75% Since 1970*, Nov. 13, 2006, http://www.mnp.nl/en.

40. *See* MITIGATION OF CLIMATE CHANGE, *supra* note 33, at 3.

41. *See* Jonathan A. Patz et al., *Impact of Regional Climate Change on Human Health*, 438 NATURE 310, 310 (2005).

42. *See* Greg A. Holland & Peter J. Webster, *Heightened Tropical Cyclone Activity in the North Atlantic: Natural Variability or Climate Trend?*, 365 PHIL. TRANSACTIONS ROYAL SOCIETY A 2695-2716 (2007); Kerry Emanuel, *Increasing Destructiveness of Tropical Cyclones over the Past 30 Years*, 436 NATURE 686, 686-88 (2005).

43. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY, WORKING GROUP II CONTRIBUTION TO THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE FOURTH ASSESSMENT REPORT, SUMMARY FOR POLICYMAKERS 2, *available at* http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-spm.pdf [hereinafter IMPACTS, ADAPTATION AND VULNERABILITY].

Overall, warming is undoubtedly exerting a substantial and pervasive influence on the globe. As the IPCC recently concluded, "[o]f the more than 29,000 observational data series, from 75 studies, that show significant change in many physical and biological systems, more than 89% are consistent with the direction of change expected as a response to warming."[44]

However, as atmospheric concentrations of greenhouse gases continue to rise, the greatest trepidation of a climate scientist lies in the outlook for this century and beyond, as atmospheric concentrations of greenhouse gases continue to rise. Absent aggressive global efforts to reduce greenhouse gas emissions, atmospheric concentrations of carbon dioxide may reach twice pre-Industrial Revolution levels as early as 2050,[45] and perhaps triple by the end of the century.[46] The latest assessment by the IPCC projects that doubling atmospheric concentrations of carbon dioxide from pre-Industrial Revolution levels is likely to cause a 2°-4.5°C increase in temperature, with a best estimate of 3°C.[47] This projection is remarkably consistent with paleoclimatic evidence. "[E]mpirical data climate change over the past 700,000 years yields a climate sensitivity of ¾° C for each W/m^2 of forcing, or 3°C for a 4 W/m^2 forcing."[48]

Moreover, the IPCC's most recent assessment's mid-range scenario projects that sea levels will rise between eighteen and fifty-nine centimeters (7-23 inches) during the remainder of this century as a consequence of projected

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44. IMPACTS, ADAPTATION AND VULNERABILITY, *supra* note 43, at 2.

45. *See* Hansen, *supra* note 15, at 4.

46. *See* Stephen F. Lincoln, *Fossil Fuels in the 21st Century*, 34(8) AMBIO 621, 621 (2005).

47. *See* IPCC, *supra* note 15, at 12; *see also* Bierbaum et al., *supra* note 29, at x:

> If CO2 emissions and concentrations grow according to mid-range projections, moreover, the global average surface temperature is expected to rise by 0.2°C to 0.4°C per decade throughout the 21st century and would continue to rise thereafter. The cumulative warming by 2100 would be approximately 3°C to 5°C over preindustrial conditions.

48. Hansen, *supra* note 15, at 7. As Hansen notes, paleoclimatic data is particularly compelling because it also includes any cloud feedbacks that may exist. *See id.* Cloud feedbacks are recognized by most climatologists as the largest source of uncertainty in climatic modeling. *See* IPCC, *supra* note 15, at 4; Richard A. Kerr, *Three Degrees of Consensus*, 305 SCI. 932, 933 (2004).

warming.[49] However, there is a very real possibility that sea levels will rise much more than this because the IPCC assessment fails to evaluate potential dynamical responses of ice sheets in Greenland and the West Antarctic,[50] which may exert substantial positive feedbacks on sea level rise over the next century and beyond.[51] As Hansen avers:

> In the longer term, if annual temperatures increase by more than 3°C in the Antarctic region, which is highly likely by the end of this century, one study projects that globally averaged sea-levels could increase by *7 meters* over a period of 1000 years or more,[52] while Hansen estimates that sea levels could rise as much as 6 meters within the next century.[53]

It is anticipated that climate change will have dire implications for both natural systems and human institutions.[54] Some of the most serious impacts on natural systems may occur in the world's oceans. In the following section, this piece will examine the potential impacts on fish

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49. *See* G.A. Meehl et al., *Global Climate Change Projections*, *in* IPCC, *supra* note 15, at 820, *available at* http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter10.pdf (last visited Feb. 16, 2008). Rising sea levels associated with climate change are attributable primarily to thermal expansion of ocean waters due to warming and glacial melting. *See* Hansen, *supra* note 16, at 16.

50. A persuasive case is made by Hansen that the IPCC in its Fourth Assessment Report failed to adequately take into account multiple positive feedbacks that could occur in Greenland and the West Antarctic should temperatures rise by 2-3°C. These include "reduced surface albedo, loss of buttressing ice shelves, dynamical response of ice streams to increased melt-water and lower sea surface ice altitude," all of which result in massive rises in sea level within a few centuries. *See* James Hansen et al., *Global Temperature Change*, 103(39) PROC. NAT'L. ACAD. SCIENCES 14288, 14292 (2006).

51. *See* Hansen, *supra* note 30, at 1936; *Scientific Reticence and Sea Level Rise*, 2 ENVTL. RES. LETTERS 1, 4 (2007); Michael Oppenheimer et al., *The Limits of Consensus*, 317 SCI. 1505, 1505 (2007).

52. *See* Jonathan M. Gregory, Philippe Huybrechts & Sarah C.B. Raper, *Threatened Loss of the Greenland Ice-Sheet*, 428 NATURE 616, 616 (2004); *see also* Julian A. Dowdeswell, *The Greenland Ice Sheet and Global Sea-Level Rise*, 311 SCI. 963, 963 (2006).

53. *See* Hansen, *supra* note 15, at 22. Hansen also concluded that a 2-3°C increase in temperatures could ultimately result in sea level rise of *25 meters* over the course of the next few hundred years. *See id.* at 21.

54. For an overview of impacts, see William C.G. Burns & Hari M. Osofsky, *Overview: The Exigencies That Drive Potential Causes of Action for Climate Change*, *in* ADJUDICATING CLIMATE CHANGE: SUB-NATIONAL, NATIONAL, AND SUPRA-NATIONAL APPROACHES (William C.G. Burns & Hari Osofsky eds., Cambridge Univ. Press 2008).

species, and more specifically, straddling and highly migratory stocks.

B. *The Potential Impacts of Climate Change on Fish Species*

As Hannesson recently concluded:

> The fisheries are even more dependent than agriculture on climatic conditions. While agriculture does up to a point compensate for the shortcomings of nature . . . , the fisheries, which essentially are an advanced form of hunting, are totally dependent on what nature will or will not provide.[55]

Fish species are ectothermic (cold blooded); thus, water temperature impacts growth and maturity rates, distribution and migration patterns, and incidence of disease and is the primary source of environmental impact on fish.[56] Substantially rising oceanic temperatures throughout this century will likely have negative impacts on highly migratory and straddling stocks species in many regions, especially those near the edge of their temperature tolerance range.[57] For example, the range of colder water fish species, such as capelin, polar cod and Greenland halibut, is likely to shrink, resulting in a decline in abundance.[58] A decline in nutrient upwelling because of increased stratification between warmer surface waters and colder deep water in warming oceans could also cause a decline in bigeye and yellowfin tuna in the central and western Pacific.[59] Tuna species are a particularly important and dependable source of revenue for Pacific small island States.[60]

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55. Rögnvaldur Hannesson, *Introduction,* 31, 1, 1 (2007).

56. *See* William E. Schrank, *The ACIA, Climate Change and Fisheries*, 31 MARINE POL'Y 5, 12 (2007); G.A. Rose, *On Distributional Responses of North Atlantic Fish to Climate Change*, 62 ICES J. MARINE SCI. 1360, 1360 (2005), *available at* http://icesjms.oxfordjournals.org/cgi/reprint/62/7/1360.

57. *See generally* EUROPEAN SCI. FOUND., IMPACTS OF CLIMATE CHANGE ON THE EUROPEAN MARINE AND COASTAL ENVIRONMENT (2007), http://www.vliz.be/docs/Events/JCD/MB_Climate_Change_VLIZ_05031.pdf.

58. *See id.* at 12; Robin A. Clark et al., *North Sea Cod and Climate Change – Modelling the Effects of Temperature on Population Dynamics*, 9 GLOBAL CHANGE BIOLOGY 1669, 1677 (2003).

59. *See* WORLD BANK, CITES, SEAS AND STORMS 27 (2004), http://siteresources.worldbank.org/INTPACIFICISLANDS/Resources/4-Chapter+5.pdf.

60. *See* Emily E. Larocque, *The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific*

Warming oceans could also radically change the distribution of some straddling stock and highly migratory species. For example, rising ocean temperatures could result in a shift of the distribution of herring northward, upsetting a delicate agreement in the Northeast between coastal States who harvest herring within their EEZs and distant water fishing nations (DWFNs)[61] who fish on the high seas.[62] Similarly, shifts in the distribution of cod and haddock in the Barents Sea may necessitate renegotiation of existing fisheries agreements between Russia and Norway.[63] "Strategic over fishing" of stocks that are currently recovering from a historical decline may occur should cooperative management agreements of this nature collapse.[64] Warming in the Pacific could similarly result in a redistribution of tuna resources to higher latitudes, such as Japan and the western equatorial Pacific.[65]

Temperature increases will also adversely affect prey species of many straddling stocks and highly migratory species. For example, in the North Atlantic, strong biogeographical shifts in copepod and plankton assemblages associated with warming trends[66] could substantially reduce the abundance of fish in the North Sea and ultimately result in the collapse of the stocks of cod, an important straddling stock species.[67] There are already disturbing portents of this,

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Ocean: Can Tuna Promote Development of Pacific Island Nations?, 4 ASIAN-PAC. L. & POL'Y J. 83, 87 (2003).

61. "DWFNs are landlocked states and states that have the fleet capacity to fish distant regions." Julie R. Mack, *International Fisheries Management: How the U.N. Conference on Straddling and Highly Migratory Fish Stocks Changes the Law of Fishing on the High Seas*, 26 CAL. W. INT'L L.J. 313, 316 (1996). "Japan, Russia, South Korea, Spain, Taiwan, and Poland account for almost ninety percent of the world's high seas fish catch." Note, *supra* note 11, at 81.

62. *See* Elin H. Sissener & Trond Bjørndal, *Climate Change and the Migratory Pattern for Norwegian Spring-Spawning Herring – Implications for Management*, 29 MARINE POL'Y 299, 305 (2005); Francis Neat & David Righton, *Warm Water Occupancy by North Sea Cod*, 274 PROC. ROYAL SOC'Y B 789, 789 (2007).

63. *See* EUROPEAN SCI. FOUND., *supra* note 57, at 23.

64. *See id.* at 304.

65. *See* WORLD BANK, *supra* note 59, at 28.

66. *See* Russell B. Wynn et al., *Climate-Driven Range Expansion of a Critically Endangered Top Predator in Northeast Atlantic Waters*, 3 BIOLOGY LETTERS 529, 530-31 (2007); G. Beaugrand & P.C. Redi, *Long-Term Changes in Phytoplankton, Zooplankton and Salmon Related to Climate*, 9 GLOBAL CHANGE BIOLOGY 801-17 (2003).

67. *See* Grégory Beaugrand et al., *Reorganization of North Atlantic Marine*

such as warming in the North Sea over the last few decades that has resulted in key changes in planktonic assemblages, causing a poor food environment for cod larvae, thereby adversely affecting recruitment success.[68] The decline of stocks has also increased their sensitivity to regional climate warming due to shrinkages in age distribution and geographical range.[69]

There will also be direct biological effects from rising levels of carbon dioxide entering the oceans. Atmospheric carbon dioxide increases at a rate of only approximately 50% of human carbon dioxide emissions because of the existence of large ocean and terrestrial sinks that absorb carbon dioxide emissions.[70] Over the past two centuries, the world's oceans have absorbed 525 billion tons of carbon dioxide, constituting nearly half of carbon emissions over this period.[71] This, in turn, could result in the average pH of the oceans falling by 0.5 units by 2100, which would translate into a three-fold increase in the concentration of hydrogen ions, making the oceans more acidic than they have been in 300 million years.[72]

Copepod Biodiversity and Climate, 296 SCI. 1692, 1693 (2002); *see also* Anthony J. Richardson & David S. Schoeman, *Climate Impact on Plankton Ecosystems in the Northeast Atlantic*, 305 SCI. 1609-12 (2004).

68. *See* INST. FOR ENV'T & SUSTAINABILITY, EUROPEAN COMMISSION DIRECTORATE GENERAL JOINT RESEARCH CENTRE, MARINE AND COASTAL DIMENSION OF CLIMATE CHANGE IN EUROPE 24 (2006), http://ies.jrc.cec.eu.int/fileadmin/Documentation/Reports/Varie/cc_marine_report_optimized2.pdf.

69. *See id.*

70. Richard A. Feely, Christopher L. Sabine & Victoria J. Fabry, *Carbon Dioxide and Our Ocean Legacy,* NOAA, Pacific Marine Environmental Laboratory (2006), http://www.pmel.noaa.gov/pubs/PDF/feel2899/feel2899.pdf>, site visited on Mar. 18, 2008; Hans O. Pörtner, Martina Langenbuch & Anke Reipschläger, *Biological Impact of Elevated Ocean CO_2 Concentrations: Lessons from Animal Physiology and Earth History,* 60 J. OCEANOGRAPHY 705, 707 (2004).

71. *See* RICHARD A. FEELY, CHRISTOPHER L. SABINE & VICTORIA J. FABRY, NOAA, PACIFIC MARINE ENVIRONMENTAL LABORATORY, CARBON DIOXIDE AND OUR OCEAN LEGACY 1 (2006), http://www.pmel.noaa.gov/pubs/PDF/feel2899/feel2899.pdf; Ulf Riebesell et al., *Reduced Calcification of Marine Plankton in Response to Increased Atmospheric CO_2*, 407 NATURE 364, 364 (2000). "At present, ocean chemistry is changing at least 100 times more rapidly than it has changed during the 650,000 years preceding our industrial era." FEELY ET AL., *supra* note 71, at 2.

72. *See* Ben I. McNeil & Richard J. Matear, *Climate Change Feedbacks on Future Oceanic Acidification,* 59(B) TELLUS 191, 191 (2007). *See also* J.C. Blackford & F.J. Gilbert, *pH Variability and CO_2 Induced Acidification in the North Sea,* 64 J. MARINE SYSTEMS 229, 229 (2007).

Acidification of the oceans will result in a decrease in the concentration of carbonate and related ions that reef building and other calcifying organisms[73] draw upon to produce calcium carbonate.[74] Shell and skeleton-building rates of organisms with carbonate shells and skeletons declined by as much as 50% in recent experiments in which dissolved carbon dioxide was increased to double pre-Industrial Revolution levels.[75]

Among the species that might be severely affected are a group of planktonic snail species with calcium carbonate shells called pteropods. In the Ross Sea, the subpolar-polar pteropod *Limacina helicina* sometimes replaces krill as the dominant zooplankton species in the ecosystem.[76] A recent study indicates that increased acidification of pteropod habitats in the Sea might ultimately result in the disappearance of the species from Antarctic waters, or shift its distribution to lower latitudes.[77] The potential exclusion of the pteropod from other polar and sub-polar regions could have negative impacts on several straddling stock species for which it is a prey species, including North Pacific salmon, mackerel, herring and cod.[78] Other potential impacts of reduced pH in the oceans could include disruptions in the carbon cycle and the nutrient ratios, which could adversely

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. The dissolution of carbon dioxide in the oceans results in the production of a weak acid, called carbonic acid. *See* Joan A. Kleypas et al., *Geochemical Consequences of Increased Atmospheric Carbon Dioxide on Coral Reefs*, 284 SCI. 118, 118 (1999). Carbonic acid readily releases hydrogen ions, the concentration of which determines the acidity of the water body. *See* THE ROYAL SOC'Y, OCEAN ACIDIFICATION DUE TO INCREASING ATMOSPHERIC CARBON DIOXIDE, POLICY DOC. 12/05, at 6 (2005), http://www.royalsoc.ac.uk/displaypagedoc.asp?id=13539.

73. An example of non-coral reef builders is rudistid bivalves, which secrete calcium carbonate shells or skeletons. *See* Kaustuv Roy & John M. Pandolfi, *Responses of Marine Species and Ecosystems to Past Climate Change*, *in* CLIMATE CHANGE & BIODIVERSITY 164 (Thomas E. Lovejoy & Lee Hannah eds., 2005).

74. *See* O. HOEGH-GULDBERG ET AL., GREENPEACE, PACIFIC IN PERIL, 14 (2000), *available at* http://www.greenpeace.org/raw/content/australia/resources/reports/climate-change/coral-bleaching-pacific-in-pe.pdf.

75. *See* FEELY ET AL., *supra* note 71, at 2.

76. *See* James C. Orr et al., *Anthropogenic Ocean Acidification Over the Twenty-First Century and its Impact on Calcifying Organisms*, 437 NATURE 681, 685 (2005).

77. *See id.*

78. *See id.*; FEELY ET AL., *supra* note 71, at 3.

affect phytoplankton species critical for many fish species, including straddling stocks and high migratory species.[79]

In the next section, this article will examine the prospects for national and international institutional responses to climate change, primarily national legislation and treaties, to address the threats posed by climate change, including fish species.

C. *International Legal Responses to Climate Change*

The primary international legal response to climate change to date is the United Framework Convention on Climate Change (UNFCCC),[80] which entered into force in 1994 and has been ratified by 189 countries and the European Economic Community (EEC).[81] Unfortunately, resistance by several nations, most prominently the United States and OPEC States, to mandatory reduction targets for greenhouse gas emissions led the drafters to resort to "constructive ambiguities" and "guidelines, rather than a legal commitment."[82] Thus, the UNFCCC merely calls on the Parties in Annex I (developed countries and economies in transition) to "aim" to return their emissions back to 1990 levels.[83]

By 1995, the greenhouse gas emissions of most developed countries were already well above 1990 levels and a study by the Organization of Economic Cooperation and Development projected that emissions from industrialized countries would rise between 11- 24% over the next fifteen years.[84] The realization that more substantive measures were necessary ultimately led to the adoption of the Kyoto Protocol to the

79. *See* INST. FOR ENV'T & SUSTAINABILITY, *supra* note 68, at 39.

80. *See* United Nations Conference on Environment and Development: Framework Convention on Climate Change, May 9, 1992, 31 I.L.M. 849 [hereinafter UNFCCC].

81. *See* United Nations Framework Convention on Climate Change Secretariat, *UNFCCC: Status of Ratifications*, http://unfccc.int/files/essential_background/convention/status_of_ratification/application/pdf/unfccc_ratification_22.11.06.pdf (last visited Mar. 7, 2007).

82. Ranee Khooshie Lai Panjabi, *Can International Law Improve the Climate? An Analysis of the United Nations Framework Convention on Climate Change Signed at the Rio Summit in 1992*, 18 N.C. J. INT'L L & COM. REG. 491, 494 (1993).

83. *See* UNFCCC, *supra* note 80, art. 4(2)(b).

84. *See* Bas Arts, *New Arrangements in Climate Policy*, 52 CHANGE 1, 2 (2000).

UNFCCC[85] at the Third Conference of the Parties in 1997. The Protocol entered into force in 2005 and currently has 169 States and the EEC as Parties.[86]

The Protocol calls for industrialized States and States with economies in transition to reduce their aggregate greenhouse gas emissions to at least 5% below 1990 levels in the commitment period of 2008 to 2012.[87] In addition, parties will establish commitments for subsequent periods through amendments to pertinent provisions of the Protocol, with consideration of such commitments to begin at least seven years before the end of the first commitment period.[88]

Unfortunately, for several reasons, the Protocol is not the panacea that the popular press sometimes portrays it to be. First, President Bush announced in 2001 that the United States, responsible for 25% of the world's anthropogenic greenhouse gas emissions, would not become a Party to the Protocol.[89] As an alternative, the President proposed the "Global Climate Initiative" (GCI) as part of his 2002 "Clear Skies Initiative," which would seek to reduce the "greenhouse gas intensity" of the U.S. economy by 18% over the next ten years.[90] "Greenhouse gas intensity" is defined as the ratio of greenhouse gases to economic output.[91]

While touted as a bold approach by the Bush Administration, in reality, the GCI constituted an extremely tepid response by the world's largest producer of greenhouse gases. While the Kyoto Protocol would have committed the United States to reduce its greenhouse gas emissions by seven percent below 1990 levels,[92] under the GCI it is

85. *See* Conference of the Parties to the Framework Convention on Climate Change: Kyoto Protocol, Dec. 10, 1997, 37 I.L.M. 22 [hereinafter Kyoto Protocol].

86. *See* United Nations Framework Convention on Climate Change Secretariat, *supra* note 81.

87. *See id.* art. 3(1).

88. *See id.* art 3(9); art. 21(7).

89. *See* Press Release, White House Office of the Press Secretary, President Bush Discusses Global Climate Change (June 11, 2001), http://www.whitehouse.gov/news/releases/2001/06/20010611-2.html.

90. *See* The White House, Global Climate Change Policy Book (Feb. 2002), http://www.whitehouse.gov/news/releases/2002/02/climatechange.html. The proposal also called, *inter alia*, for increasing funding for climate change research by $700 million in FY 2003. *See id.*

91. *See id.*

92. *See* Kyoto Protocol, *supra* note 85, at Annex B.

estimated that emissions will rise to 32% above 1990 levels.[93] The GCI ultimately withered on the vine after failing to clear out of the Senate Environment and Public Works Committee in March of 2005.[94]

While the Bush Administration has continued to tout a voluntary, technologically-driven approach, the UNFCCC Secretariat recently projected that U.S. greenhouse gas

93. *See* Detlef van Vuuren et al., *An Evaluation of the Level of Ambition and Implications of the Bush Climate Change Initiative*, 2 CLIMATE POL'Y 293, 295 (2002); A.P.G. DE MOOR ET AL., DUTCH MINISTRY OF ENV'T, EVALUATING THE BUSH CLIMATE CHANGE INITIATIVE, RIVM Report 278001019/2002, at 13 (2002).

94. *See* Michael Janofsky, *Bush-Backed Emissions Bill Fails to Reach Senate Floor*, N.Y. TIMES, Mar. 10, 2005, http://www.truthout.org/cgi-bin/artman/exec/view.cgi/34/9550. The United States, China, India, Japan, South Korea and Australia, responsible for 49% of the world's greenhouse gas emissions, did agree to form the Asia-Pacific Partnership on Clean Development and Climate in 2005. The Partnership's primary objective is to "promote and create an enabling environment for the development, diffusion, deployment and transfer of existing and emerging cost-effective, cleaner technologies and practices . . . ." Potential areas for collaboration include development of energy efficiency programs, clean coal, renewable energy sources, including wind, solar, and geothermal, and carbon sequestration projects. It is contemplated that a non-binding compact will be established to specify terms of implementation of the Partnership. Press Release, Prime Minister of Austl., *Vision Statement of Australia, China, India, Japan, the Republic of Korea and the United States of America for a New Asia-Pacific Partnership on Clean Development and Climate* (July 28, 2005), http://www.pm.gov.au/news/media_releases/media_Release1482.html#statement; ANNA MATYSEK ET AL., ABARE RESEARCH REPORT, TECHNOLOGY – ITS ROLE IN ECONOMIC DEVELOPMENT AND CLIMATE CHANGE 7, (2006), http://www.abareconomics.com/publications_html/climate/climate_06/cc_technology.pdf. However, the Partnership agreement is unlikely to substantially change the terrain as it does not incorporate legally binding commitments or targets to reduce greenhouse gas emissions, obviating the incentive for the public and private sectors to deploy costly new technologies, and does not, at this point, have a funding mechanism for the programs it outlines, including facilitation of transfers of low-emission technologies to developing countries. *See* ZHONGXIANG ZHANG, REDEFINING ASIA: VISIONS AND REALITIES, HARVARD PROJECT FOR ASIAN AND INTERNATIONAL RELATIONS 26 (2006), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=920756 ; Richard Black, *Climate Pact: For Good or Bad?*, BBC NEWS, July 28, 2005, http://news.bbc.co.uk/1/hi/sci/tech/4725681.stm. As Anthony Hobley, Chairman of the London Climate Change Services concluded: "This partnership does not provide anything additional to the UNFCCC to which all of the countries involved have already signed up." Liz Bossley, *Asia-Pacific Partnership: Complementing or Competing with Kyoto?*, XLVIII MIDDLE EAST ECON. SURVEY, No. 32, Aug. 8, 2005, http://www.mees.com/postedarticles/oped/v48n32-5OD01.htm. Moreover, to date, Australia and the United States combined have pledged to spend a paltry $455 million over the next five years on clean energy projects *See* Clair Miller, *New Climate Partnership Makes Little Difference*, 4(2) FRONTIERS IN ECO. & ENV'T 60, 60 (2006).

emissions will be more than 32% above 1990 levels by 2010, and more than 50% above 1990 levels by 2020.[95] The steady upward projection of emissions is in no small part attributable to the U.S.'s continued commitment to coal, which produces triple the carbon dioxide per unit of energy as natural gas and double that of oil.[96] Fifty percent of the electricity generated in the United States is currently produced from coal and an estimated 130 new coal-fired plants are on the drawing boards.[97] As the IPCC recently observed, energy infrastructure decisions over the next few decades will exert substantial influence on future greenhouse gas emissions given the long lifetimes of such facilities.[98]

There is some hope that the United States may be prepared to re-engage the world community. At the G8 Summit in June of 2007, the United States joined the other States in adopting an "Agenda for Global Growth and Stability," which included a section on addressing climate change. In the Agenda, the G8 States acknowledged the need for "resolute and concerted action" to reduce greenhouse gas emissions, and that "tackling climate change is a shared responsibility for all."[99] However, primarily because of U.S. resistance, the G8 stopped short of agreeing to specific targets and timetables for reducing emissions. Rather, it only pledged to "consider seriously" the decisions made by the European Union (EU), Canada and Japan to reduce emissions by at least half of 1990 levels by 2050.[100] Later in 2007, President Bush invited the EU, the United Nations and

95. *See* UNFCCC Secretariat, *Data Appendices to UNFCCC Presentation at the AWG Workshop*, Nov. 7, 2006, at 6, *available at* http://unfccc.int/files/meetings/cop_12/in-session_workshops/application/pdf/061107_6_ghg_app.pdf.

96. *See* William K. Stevens, *Global Economy Slowly Cuts Use of High-Carbon Energy*, N.Y. TIMES, Oct. 31, 1999, at A12. Coal-burning plants contributed most of the new carbon dioxide emitted by the electric power sector, which in turn has accounted for nearly half of the 18% increase in carbon dioxide emissions in the United States between 1990 and 2004. *See* Megan Tady, *Climate Change Gas Emissions Way Up Nationwide*, ALTERNET, Apr. 20, 2007, http://www.alternet.org/story/50624.

97. *See* PEW CTR. ON GLOBAL CLIMATE CHANGE, COAL AND CLIMATE CHANGE FACTS, http://www.pewclimate.org/global-warming-basics/coalfacts.cfm (last visited Feb. 16, 2008).

98. *See Mitigation of Climate Change*, *supra* note 33, at 18.

99. G8 SUMMIT 2007 HEILIGENDAMM, GROWTH AND RESPONSIBILITY IN THE WORLD ECONOMY ¶40-41 (2007).

100. *See id.* ¶49.

eleven industrial and developing States to work toward a long-term goal for emissions reductions by 2008.[101] However, some environmentalists fear that the United States may be seeking to undermine the Kyoto process, especially since the Bush administration has continued to oppose mandatory emissions caps.[102]

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101. *See* Matt Spetalnick, *Bush Calls for Meeting on Global Warming for September*, PLANET ARK, http://www.planetark.com/dailynewsstory.cfm/newsid/43467/story.htm (last visited Feb. 16, 2008).

102. *See id.* Another potential positive development in the United States is a flurry of legislative activity in the 110th Congress to address climate change, with more than 125 bills, resolutions and amendments introduced through July 2007 to address climate change. *See* Pew Ctr. on Global Climate Change, Legislation in the 110th Congress Related to Global Climate Change, http://www.pewclimate.org/what_s_being_done/in_the_congress/110thcongress.cfm (last visited Aug. 9, 2007). Several of the bills would establish cap and trade systems that would dramatically reduce emissions over the course of the next few decades, but the prognosis for passage of such measures now appear "slim" for this session. *See Full of Sound and Fury*, THE ECONOMIST, July 12, 2007, *available at* http://www.economist.com/world/na/displaystory.cfm?story_id=9475971; *see also* Craig Bennett & Dan Adamson, *The Bumpy Road to Federal CO_2 Caps*, POWER, July 2007, at 43. At the sub-national level, there are also a number of regional and state initiatives to address climate change that may ultimately have a positive impact. For example, in 2006, California, which is the twelfth largest emitter of carbon dioxide globally, passed the California Global Warming Solutions Act, or AB32. *See* Press Release, Office of the Governor, *Gov. Schwarzenegger Signs Landmark Legislation to Reduce Greenhouse Gas Emissions* (Sept. 27, 2006), http://gov.ca.gov/index.php?/press-release/4111/; *see also* Assemb. B. 32, 2007-2008 Reg. Sess. (Cal. 2006), http://www.leginfo.ca.gov/pub/07-08/bill/asm/ab_0001-0050/ab_32_bill_20070501_amended_asm_v96.pdf [*hereinafter* AB32]. AB32 calls for the state to reduce its greenhouse emissions to 1990 levels by 2020. *See id.* § 38550. The law provides for the establishment of additional targets thereafter, with the ultimate goal of reducing the state's emissions by 80% below 1990 levels by 2050. *See* Office of the Governor, *supra*. It remains to be seen, however, whether the state can achieve this goal in the face of a projected doubling of its population in the next 40 years and likely political pressure to downgrade the commitment if there is not ultimately a commensurate federal mandate. *See* Bruce Murray, *Global Cooling in the Sunshine State*, ANALYSIS ONLINE, Oct. 30, 2006, http://www.analysisonline.org/site/aoarticle_display.asp?issue_id=2&sec_id=140002434&news_id=140001412. In the east, ten states have now joined the Regional Greenhouse Gas Initiative (RGGI), which sets a cap on power plant emissions at approximately current levels of 120 million tons of carbon dioxide between 2009 and 2015, and then 10% below this level by 2019. *See* Reg'l Greenhouse Gas Initiative, *Frequently Asked Questions*, http://www.rggi.org/docs/mou_faqs_12_20_05.pdf (last visited Feb. 16, 2008). Even assuming the states achieve this goal, this is an extremely modest commitment compared to what ultimately must be done, but at least RGGI

Second, in developing the rules for implementing the Protocol, many concessions were made to wavering nations that substantially diluted the Parties' commitments. Thus, some analysts believe that implementation of the Protocol will ultimately result in substantially less reductions in emissions than originally contemplated, or even a net *increase* over 1990 levels.[103]

Third, it is far from clear that most of the industrialized State Parties to Kyoto will fulfill their obligations in the first commitment period. For example, Japan's emissions are currently more than 14% above its Kyoto targets.[104] Canada's emissions are now more than 30% above 1990 levels,[105] and the government recently acknowledged that it will not meet its commitments, but will seek to achieve less ambitious

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establishes an institutional framework in the region that hopefully will both commit to further reductions in the future and help to pressure the federal government to establish national mandates. Moreover, a large number of states are taking actions to reduce greenhouse gas initiatives, including through renewable portfolio standards, greenhouse gas emissions targets, and tax incentives to reduce emissions. *See* PEW CTR. ON GLOBAL CLIMATE CHANGE, CLIMATE CHANGE 101: STATE ACTION, http://www.pewclimate.org/docUploads/101_States.pdf (last visited Feb. 16, 2008).

103. *See* Tom Athanasiou & Paul Baer, *Bonn and Genoa: A Tale of Two Cities and Two Movements*, Foreign Policy in Focus, Discussion Paper, Aug. 2001, at 3 (discussing that concessions made in negotiations to flesh out Kyoto Protocol could "render the protocol's nominal mandate of a 5.2% overall reduction in rich-world emissions (from their 1990 baseline) into a 0.3% increase); Miranda A. Schreurs, *Competing Agendas and the Climate Change Negotiations: The United States, the European Union, and Japan*, 31 ENVTL. L. REP. 11218, 11218 (2001).

104. *See* Ikuko Kao & Neil Chatterjee, *Japan's Kyoto Gap Widens as Emissions Rise*, PLANET ARK, Oct. 18, 2006, http://www.planetark.com/dailynewsstory.cfm/newsid/38538/story.htm; *see also Japan Emissions to Rise, Kyoto Target at Risk - Paper*, PLANET ARK, Aug. 9, 2007, http://www.planetark.com/dailynewsstory.cfm/newsid/43564/story.htm (stating that Japan's greenhouse gas emissions will rise by 0.9% in the fiscal year ending in March 2011).

105. *See* Rob Gillies, *Canada Won't Meet Kyoto Emissions Targets*, BOSTON.COM, Apr. 26, 2007, http://www.boston.com/news/world/canada/articles/2007/04/26/canada_wont_meet_kyoto_emission_targets/. The government's own new "Turning the Corner" climate change strategy would put Canada 39% above its Kyoto target in 2012. *See* Envtl. News Serv., *Canada Sued for Abandoning Kyoto Climate Commitment*, ECOJUSTICE, May 29, 2007, *available at* http://www.ecojustice.ca/media-centre/press-clips/canada-sued-for-abandoning-kyoto-climate-commitment/?searchterm=Canada%20Sued%20for%20Abandoning%20Kyoto%20Climate%20Commitment.

targets.[106] Even the EU, the staunchest supporter of the Protocol, is struggling to meet its commitments. Greenhouse gas emissions in the EU rose in 2004 and 2005,[107] and seven of the EU-15 States are projected to exceed their individual emission limits set by the EU.[108] The European Commission projects that the bloc's Kyoto commitment will be met through the implementation of additional initiatives, but has emphasized that there is little room for error at this point.[109]

Finally, even if the Kyoto Protocol, as originally drafted, was faithfully implemented by all industrialized nations, it would constitute only an extremely modest down payment on what ultimately must be done to stabilize atmospheric concentrations of greenhouse emissions. This is true for two primary reasons. First, as indicated above, the Kyoto Protocol calls for Annex I Parties to reduce their overall greenhouse gas emissions by 5% in the first commitment period.[110] By contrast, stabilization of atmospheric greenhouse gases at levels that produce no more than a 2-3°C increase in temperatures from pre-Industrial Revolution levels, which many climate experts cite as a critical "climate tipping point that could lead to intolerable impacts on human well-being,"[111] will require the world community to reduce

106. *See* Gillies, *supra* note 105. Under the latest plan promulgated by the conservative Canadian government, Canada will not meet its commitments under the Kyoto Protocol until 2025, rather than 2012. *See Environmentalists Pan Harper's Pitch on Climate*, CTV.CA, June 4, 2007, http://www.ctv.ca/servlet/ArticleNews/story/CTVNews/20070603/harper_g8_070604/20070604?hub=Canada.

107. *See* Helena Spongenberg, *EU Falls Behind on Green Targets*, EUOBSERVER.COM, June 23, 2006, *available at* http://euobserver.com/9/21944/?rk=1.

108. *See* Press Release, Europa, Climate Change: Member States Need to Intensify Efforts to Reach Kyoto Emission Targets (Oct. 27, 2006), http://europa.eu/rapid/pressReleasesAction.do?reference=IP/06/1488&format=HTML&aged=0&language=EN&guiLanguage=en.

109. *See id.*

110. *See* UNFCCC SECRETARIAT, *supra* note 87.

111. Bierbaum et al., *supra* note 29, at xi; *see also* PAUL BAER & TOM ATHANASIOU, HONESTY ABOUT DANGEROUS CLIMATE CHANGE, ECOEQUITY, http://www.ecoequity.org/ceo/ceo_8_2.htm#dangerous (last visited Feb. 16, 2008); B.C. O'Neill & M. Oppenheimer, *Climate Change - Dangerous Climate Impacts and the Kyoto Protocol*, 296 SCI. 1971-72 (2002). However, it needs to be emphasized that even lower temperature increases will have serious implications. For example, a 1°C increase in atmospheric temperatures will seriously imperil the world's coral reef ecosystems, as well as many other ecosystems in developing countries. *See id.* at 1971; HADLEY CTR., AVOIDING DANGEROUS CLIMATE CHANGE, INTERNATIONAL SYMPOSIUM ON THE

greenhouse gas emissions by 60-70%.[112] Moreover, industrialized countries might have to reduce their emissions by as much as 80% by the middle of the century if developing nations are to be permitted some growth in their emissions levels.[113]

Second, the Protocol currently does not impose emissions reduction commitments on developing countries, even though it is projected that the developing world's share of global emissions will be approximately 55% by 2025.[114] Indeed, the Netherlands Environmental Assessment Agency recently concluded that China, with fossil fuel consumption in recent years rising at a blistering pace of more than 9% annually,[115]

STABILISATION OF GREENHOUSE GAS CONCENTRATIONS 14 (2005), http://www.stabilisation2005.com/Steering_Commitee_Report.pdf.

112. *See* JOSEPH E. ALDY ET AL., PEW CTR. ON GLOBAL CLIMATE CHANGE, Q&A: KYOTO PROTOCOL 23 (2001), http://www.pewclimate.org/docUploads/Long%2DTerm%20Target%2Epdf (stating that stabilization of atmospheric carbon dioxide levels at 550 parts per million, yielding an estimated 1.6-2.9°C increase in temperatures from pre-industrial levels, necessitates 60% reduction in emissions); Jonathan Pershing & Fernando Tudela, *A Long-Term Target: Framing the Climate Effort*, *in* BEYOND KYOTO: ADVANCING THE INTERNATIONAL EFFORT AGAINST CLIMATE CHANGE (Joseph E. Aldy et al. eds., 2004), A recent study by Hare and Meinshausen suggests that the cutbacks may have to be even more dramatic. The study concludes that there is a 66% risk of overshooting a 2°C increase of temperatures from pre-industrial levels even if atmospheric concentrations of carbon dioxide are held to 450 parts per million. *See* Bill Hare & Malte Meinshausen, *How Much Warming Are We Committed to and How Much Can be Avoided?*, 75 CLIMATIC CHANGE 111, 129 (2006). The authors conclude that "[o]nly scenarios that aim at stabilization levels at or below 400 ppm CO_2 equivalence (~ 350ppm CO_2) can limit the probability of exceeding 2°C to reasonable levels . . . ." *Id.* at 137. Even stabilization at 650ppm CO_2 equivalence would require reductions of approximately 50% by 2100. *See* Detlef P. van Vuuren et al., *Stabilizing Greenhouse Gas Concentrations at Low Levels: An Assessment of Reduction Strategies and Costs*, 81 CLIMATIC CHANGE 119, 120 (2007).

113. *See* David D. Doniger, Antonia V. Herzog & Daniel A. Lashof, *An Ambitious, Centrist Approach to Global Warming Legislation*, 314 SCI. 764, 764 (2006); ECOFYS GMBH ET AL., WWF CLIMATE SCORECARDS: COMPARISON OF THE CLIMATE PERFORMANCE OF THE G8 COUNTRIES 4 (2005), *available at* http://www.panda.org/downloads/climate_change/g8scorecardsjun29light.pdf.

114. *See* KEVIN BAUMERT & JONATHAN PERSHING, PEW CTR. ON GLOBAL CLIMATE CHANGE, CLIMATE DATA: INSIGHTS AND OBSERVATION, 16 (2004). Overall, the Parties to the Kyoto Protocol only generate approximately one third of the world's greenhouse emissions. *See* PEW CTR. ON GLOBAL CLIMATE CHANGE, *supra* note 28, at 36.

115. *See* Robert Collier, *China About to Pass U.S. as World's Top Generator of Greenhouse Gases*, SFGATE.COM, Mar. 5, 2007, http://sfgate.com/cgi-bin/article.cgi?file=/c/a/2007/03/05/MNG18OFHF21.DTL&type=printable. China's carbon dioxide emissions over the period of 2001-2006 were almost

surpassed the United States in 2006 in aggregate carbon dioxide emissions.[116]

Given the modest commitments undertaken under Kyoto, and the likely continued rapid growth of emissions in the United States and large developing States, it is not surprising that the U.S. Energy Information Agency recently projected that worldwide emissions under Kyoto would be 43,000 million metric tons in 2030, only slightly below the business as usual projection of 43,676 million metric tons.[117] Overall, climate researchers have estimated that full implementation of Kyoto would reduce projected warming in 2050 by only about *one twentieth of one degree* and projected sea level rise by a mere *five millimeters*.[118]

The glacial pace of progress under the UNFCCC and the Kyoto Protocol has led to growing despair by many actors, including non-governmental organizations (NGOs), state and local governments in the United States, and in many nations, especially Southern States that are particularly vulnerable to the threat of climate change. Indeed, the trepidation of such stakeholders has been exacerbated in the past few years by the failure of the United States to signal its willingness to re-engage in the Kyoto process,[119] as well as tepid support for future commitments by other major greenhouse gas emitting States, including China, Russia and India.[120] While the

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350% higher than the emissions of the United States, Canada, the European Union, South Korea, Australia, and New Zealand *combined*. *See id.*

116. *See* Press Release, Netherlands Envtl. Assessment Agency, *Chinese CO2 in Perspective* (June 22 2007), http://www.mnp.nl/en/service/pressreleases/2007/20070622ChineseCO2emissionsinperspective.html.

117. *See* Michael Gerrard, *Introduction and Overview*, *in* GLOBAL CLIMATE CHANGE AND U.S. LAW 13 (Michael B. Gerrard ed., 2007).

118. *See* Martin Parry et al., *Buenos Aires and Kyoto Targets Do Little to Reduce Climate Change Impacts*, 8(4) GLOBAL ENVTL. CHANGE 285, 285 (1998); *see also* Mustafa H. Babiker, *The Evolution of a Climate Regime: Kyoto to Marrakech and Beyond*, 5 ENVTL. SCI. & POL'Y 195, 202 (2002).

119. For example, at the most recent meeting of the Group of 8 industrialized nations, the United States refused to endorse carbon trading, one of the center pieces of the Kyoto Protocol, as a means to reduce emissions. *See also U.S. Blocks Consensus of G8-plus-Five on Global Warming Issues*, GREENWIRE, Mar. 19, 2007, *available at* LEXIS-NEXIS, News.

120. *See* Alister Doyle, *UN Climate Talks Stagnate Despite Public Worries*, REUTERS ALERTNET, Mar. 2, 2007, http://www.alertnet.org/thenews/newsdesk/L02239660.htm. Russia and India are, respectively, the third and fourth largest producers of greenhouse gas emissions globally, after China and the United States. *See* Nita Bhalla, *India*

UNFCCC Secretariat lauded the purported "Spirit of Nairobi" at the latest (twelfth) Conference of the Parties (COP) held in Kenya,[121] in reality, the Parties have made very little progress in developing a framework for long-term reductions in greenhouse gas emissions.[122] Particularly disconcerting was the successful opposition by the G77 countries and China to the European Union's efforts to insert language in negotiating documents that would have committed the Parties to try to keep temperature increases below 2°C.[123] Furthermore, the G77/China bloc expressed the view that developing countries should not be required to assume binding obligations to reduce emissions, given their need for rapid economic growth and development.[124] Rather, the focus at COP12 was on adapting to climate change impacts that increasingly seem inevitable.[125]

Says its Carbon Emissions not Harming the World, ENV'TL. NEWS NETWORK, Dec. 14, 2006, http://www.enn.com/top_stories/article/5645. The European Union in February of 2007 did agree to reduce emissions to 20% below 1990 levels by 2020 and will push for a 30% commitment by industrialized States by that date. *See* Press Release, Europa, Climate Change and the EU's Response, (Feb. 15, 2007), http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/07/58&format=HTML&aged=0)#uage=EN&guiLanguage=enIan; Ian Traynor & David Gow, *EU Promises 20% Reduction in Carbon Emissions by 2020*, GUARDIAN UNLIMITED, Feb. 21, 2007, http://www.guardian.co.uk/environment/2007/feb/21/climatechange.climatechangeenvironment.

121. *See* Press Release, UNFCCC Secretariat, "Spirit of Nairobi" Prevails as United Nations Climate Change Conference Successfully Concludes with Decisions to Support Developing Countries (Nov. 17, 2006), http://unfccc.int/files/press/news_room/press_releases_and_advisories/application/pdf/20061117_cop_12_closing-english.pdf.

122. *See* Wolfgang Sterk et al., *The Nairobi Climate Change Summit (COP12-MOP2): Taking a Deep Breath before Negotiating Post-2012 Targets*, 2 J. EUR. ENVTL. & PLANNING L. 139, 141 (2007). At COP12, the Parties only agreed to a work program to analyze mitigation potentials, possible means to achieve mitigation objectives, and consideration of further commitments by Annex I Parties only. *See id.*

123. *See id.*

124. *See* Chukwumerije Okereke et al., *Assessment of Key Negotiating Issues at Nairobi Climate COP/MOP and What it Means for the Future of the Climate Regime, Tyndall Centre for Climate Change Research* (Working Paper No. 106, 2006), at 18, *at* http://www.oxfordclimatepolicy.org/publications/TyndallWorkingPaper2007.pdf (last visited Mar. 23, 2008). More hopefully, the most recent Chinese Five Year Plan includes a commitment to reduce energy intensity by 20% by 2010. *See id.* at 19.

125. *See* UNFCCC, *Further Commitments for Annex I Parties and Programme of Work* (Ad Hoc Working Group, 2006),

D. UNFSA and Climate Change

1. Overview of UNFSA

The Third United Nations Conference of the Law of Sea convened in 1973 and culminated nine years later in the adoption of the United Nations Convention on the Law of the Sea (UNCLOS).[126] UNCLOS entered into force in 1994 and currently has 148 parties.[127] A major component of UNCLOS is provisions for the regulation of fisheries, with an emphasis on the sovereign rights of coastal States to explore, exploit, conserve and manage living natural resources, including fish stocks, within their respective 200-mile EEZs.[128] UNCLOS thus extends coastal state jurisdiction over 90% of the world's fish resources, and almost 40% of the world's oceans.[129] The emphasis on coastal state management of fisheries resources was premised on the belief that "entry into fisheries would be controlled, thereby reducing both the potential for overfishing and for overcapitalization of fishing fleets."[130] Moreover, it was hoped that coastal States' authority to enforce regulations against all fishing vessels within their respective EEZs would obviate the problems associated with weak flag state enforcement[131] of national and international fisheries

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http://unfccc.int/files/meetings/cop_12/application/pdf/awg__conclusions.pdf; UNFCCC, *Summary of the First In-Session Workshop of the Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol* (Ad Hoc Working Group, 2006), http://unfccc.int/files/meetings/cop_12/application/pdf/awg2_in_sess__report_an.pdf.

126. United Nations Convention on the Law of the Sea, Dec. 10, 1982, 1833 U.N.T.S. 397, *available at* http://www.un.org/Depts/los/convention_agreements/texts/unclos/unclos_e.pdf.

127. *See* United Nations, Oceans and the Law of the Sea, Chronological Lists of Ratifications of, Accessions and Successions to the Convention and the Related Agreements as at [sic] 01 February 2005, *available at* http://www.un.org/Depts/los/reference_files/chronological_lists_of_ratifications.htm#The%20United%20Nations%20Convention%20on%20the%20Law%20of%20the%20Sea.

128. *See* UNCLOS, *supra* note 126, arts. 58, 61-68.

129. *See* Derrick M. Kedziora, *Gunboat Diplomacy in the Northwest Atlantic: The 1995 Canada-EU Fishing Dispute and the United Nations Agreement on Straddling and High Migratory Stocks*, 17 NW. J. INT'L L. & BUS. 1132, 1139 (1996-1997).

130. Donna R. Christie, *The Conservation and Management of Stocks Located Solely within the Exclusive Economic Zone*, *in* DEVELOPMENTS IN INTERNATIONAL FISHERIES LAW 396 (Ellen Hey ed., 1999).

131. Under UNCLOS, States are required to exercise "jurisdiction and

regulations.[132]

While many have characterized UNCLOS as "a constitution for the oceans,"[133] it provides only general governing principles for the management of straddling stocks and high migratory species. In cases where stocks are found within the EEZs of two or more coastal States, or an EEZ and an area beyond it, UNCLOS merely requires that the pertinent fishing States "seek" to agree upon management measures either directly or through sub-regional or regional organizations.[134] In the case of highly migratory species, coastal States and other States with nationals fishing in the region are exhorted to cooperate directly or through international organizations "with a view" to ensuring conservation and optimal utilization.[135] A proposal by some coastal States for an arbitration clause was beaten back by DWFNs and subsequently withdrawn.[136] Thus, States may, consistent with the provisions of UNCLOS and in good faith, fail to agree to conservation measures to protect highly migratory and straddling fish stocks.[137]

The lack of binding obligations in UNCLOS for high migratory species and straddling stocks was largely attributable to fishing in these regions not being considered a

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control in administrative, technical and social matters" over ships flying their flags. *See* UNCLOS, *supra* note 126, art. 94(1).

132. *See* Donna R. Christie, *It Don't Come EEZ: The Failure and Future of Coastal States Fisheries Management*, 14 J. TRANSNAT'L L. & POL'Y 1, 2 (2004); Christopher C. Joyner, *Compliance and Enforcement in New International Fisheries Law*, 12 TEMP. INT'L & COMP. L.J. 271, 277-78 (1998).

133. United Nations, Division for Ocean Affairs and the Law of the Sea, A Constitution for the Oceans, Remarks of Tommy T.B. Koh of Singapore, President of the Third United Nations Conference of the Law of the Sea (1982), *available at* http://www.un.org/Depts/los/convention_agreements/texts/koh_english.pdf; *Report of the Work of the United Nations Ad Hoc Open-Ended Informal Working Group to Study Issues Relating to the Conservation and Sustainable Use of Marine Biological Diversity Beyond Areas of National Jurisdiction*, A/61/65 (2006), at 21/, http://daccessdds.un.org/doc/UNDOC/GEN/N06/277/50/PDF/N0627750.pdf?OpenElement.

134. *See* UNCLOS, *supra* note 126, art. 63.

135. *See id.* art. 64.

136. *See* D.H. Anderson, *The Straddling Stocks Agreement of 1995: An Initial Assessment*, 45(2) INT'L & COMP. L.Q. 463, 465 (1996).

137. *See* Jon C. Goltz, *The Sea of Okhotsk Peanut Hole: How the United Nations Draft Agreement on Straddling Stocks Might Preserve the Pollack Fishery*, 4 PAC. RIM L. & POL'Y J. 443, 458 (1995); Mack, *supra* note 61, at 322-23.

major issue in the early 1980s.[138] However, large distant water fishing fleets were increasingly displaced from their traditional fishing grounds as coastal States began to claim their rights within their EEZs. This placed rapidly increasing pressures on high migratory species and straddling stocks.[139] Moreover, technological breakthroughs during this period, including satellite tracking, specially designed nets to compensate for the reduced density of stocks on the high seas, and larger and more efficient vessels, facilitated an ever-expanding scope of fishing operations by DWFNs.[140] Overall, the proportion of catches taken beyond 200-mile EEZs doubled during the 1990s.[141]

These trends quickly took their toll. In 1994, the U.N. Food and Agriculture Organization (FAO) reported that straddling fish stock catches in EEZs and high seas had been declining since 1989, and that many highly migratory fish stocks, including a majority of tuna species, were depleted, in some cases, severely.[142]

In 1992, the participants at the U.N. Conference on Environment and Development called for an intergovernmental conference under the auspices of the United Nations to address effective implementation of UNCLOS provisions related to straddling stocks and highly

138. *See* FAO, *supra* note 8, at 1; Anderson, *supra* note 136, at 465.

139. *See* Stuart Kaye, *Implementing High Seas Biodiversity Conservation: Global Geopolitical Considerations*, 28 MARINE POL'Y 221, 222 (2004); United Nations Conference on Straddling Fish Stocks and Highly Migratory Fish Stocks, Statement of the Chairman of the Conference at the Opening of the Organizational Session, Apr. 19, 1993, at 1, UN. Doc. A/Conf.164/7. Distant water fishing fleets were often subsidized by high seas fishing nations. *See* Alison Rieser, *International Fisheries Law, Overfishing and Marine Biodiversity*, 9 GEO. INT'L ENVTL. L. REV. 251, 263 (1997).

140. *See* A. Anna Zumwalt, *Straddling Fish Stock Spawn Fish War on the High Seas*, 3 U.C. DAVIS J. INT'L L. & POL'Y 35, 43 (1997); Rieser, *supra* note 139, at 263.

141. *See* Note, *Toward a Rational Harvest: The United Nations Agreement on Straddling Fish Stocks and Highly Migratory Species*, 5 MINN. J. GLOBAL TRADE 357, 365 (1999).

142. *See* Giselle Vigneron, *Compliance and International Environmental Agreements: A Case Study of the 1995 United Nations Straddling Fish Stocks Agreement*, 10 GEO. INT'L ENVTL. L. REV. 581, 586 (1998). The status of these stocks remains imperiled a decade later. According to the most recent analysis by the FAO, "about 30 percent of the stocks of highly migratory tuna and tuna-like species, more than 50 percent of the highly migratory oceanic sharks and nearly two-thirds of the straddling stocks and the stocks of other high seas fishery resources are overexploited or depleted." FAO, *supra* note 8, at iv.

migratory species.[143] In December of 1992, the U.N. General Assembly, recalling Agenda 21, passed Resolution 47/192, which authorized the convening of the United Nations Conference on Straddling Fish Stocks and Highly Migratory Fish Stocks (UNCSFS).[144]

In 1993, the U.N. General Assembly convened the UNCSFS, culminating in the adoption of UNFSA in August of 1995. UNFSA entered into force in December of 2001 and currently has sixty-eight Parties,[145] "including most States with significant interests in international fisheries."[146]

The Agreement's overarching objective is to "ensure long-term conservation and sustainable use of straddling fish stocks and highly migratory fish stocks . . ."[147] The Agreement's primary means of effectuating this objective is through engendering cooperation between coastal States and States fishing on the high seas by, *inter alia*:

- Seeking agreement between coastal States and States on the high seas on necessary measures for conservation of stocks in the high seas areas and straddling stocks through direct agreements and cooperation in Regional Fisheries Management Organizations;[148]
- Collecting and exchanging of critical data with respect to straddling stocks and high migratory species;[149] and
- Expanding the duties of Flag States to ensure enforcement of and compliance with the Convention's provisions, as well as the rights of other States, including port States, to ensure

143. *See* United Nations Environment Programme , Agenda 21, *Programme of Action for Sustainable Development*, ch. 17, ¶17.49(a)(b) (1992), http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=52&ArticleID=65&l=en (last visited Mar. 23, 2008).

144. *See* United Nations Conference on Straddling Fish Stocks and Highly Migratory Fish Stocks, G.A. Res. 47/192, at 145, U.N. GAOR, 47th Sess., 93d plen. mtg., Supp. No. 49, U.N. Doc. A/47/49 (Dec. 22, 1992).

145. *See* United Nations Oceans and Law of the Sea, Status of the Agreement, http://www.un.org/Depts/los/convention_agreements/convention_overview_fish_stocks.htm%20stocks (last visited Mar. 29, 2008).

146. Balton & Koehler, *supra* note 12, at 7.

147. UNFSA, *supra* note 5, art. 2.

148. *See id.* arts. 7-10.

149. *See id.* art. 14.

compliance with the Agreement.[150]

However, while the focus of UNFSA is on the relationship between coastal States and States fishing in areas beyond EEZs, there are a large number of provisions that could give rise to claims associated with climate change impacts on straddling stocks and highly migratory species.

2. UNFSA and Climate Change

UNFSA adopts the well-recognized "no harm rule" of international environmental law, which obliges States to ensure that activities within their jurisdiction or control do not result in injuries to the interests of other States or areas beyond national control.[151] UNFSA provides that "States Parties are liable in accordance with international law for damage or loss attributable to them in regard to this Agreement."[152] Many of the provisions of UNFSA, in turn, could provide the basis for a Party to bring an action against one or more other Parties for climate-related damages to fisheries.

As indicated above, the Agreement's primary objective is to ensure the long-term conservation and sustainable use of straddling fish stocks and highly migratory species.[153] The Agreement mandates that its Parties take conservation and management measures to further this objective. While the Agreement's primary focus is on the impacts of harvesting fish stocks,[154] it clearly contemplates the regulation of other potential activities that could imperil the conservation and

150. *See id.* arts. 19-23.

151. *See* Nuclear Tests (Austl. v. Fr.) 1973 I.C.J. (Dec. 1974); 2 RESTATEMENT (THIRD) OF FOREIGN RELATIONS LAW OF THE UNITED STATES § 601(1987); *see also* RODA VERHEYEN, CLIMATE CHANGE DAMAGE & INTERNATIONAL LAW 146 (2005); Richard S.J. Tol & Roda Verheyen, *State Responsibility and Compensation for Climate Change Damages — A Legal and Economic Assessment*, 32 ENERGY POL'Y 1109, 1110 (2004). As embodied in documents such as Principle 2 of the Rio Declaration, Principle 21 of the Stockholm Declaration, treaties, including the UNFCCC, and the Trail Smelter Arbitration in the 1941, the no harm rule "has its foundations in the principle of good neighbourliness between States formally equal under international law." *See id.*

152. UNFSA, *supra* note 5, art. 35.

153. *See* UNFSA, *supra* note 147.

154. *See* Timothy D. Smith, *United States Practice and the Bering Sea: Is it Consistent with a Norm of Ecosystem Management?*, 1 OCEAN & COASTAL L.J. 141, 150 (1995).

sustainable use of such stocks. For example, UNFSA requires the Parties to assess the impact of "other human activities and environmental factors on target stocks and species belonging to the same ecosystem or associated with or dependent upon the target stocks."[155]

Moreover, the Agreement requires the Parties to "minimize pollution."[156] While the Agreement does not define the term "pollution," Article 4 provides that UNFSA is to be "interpreted and applied in the context of and in a manner consistent with the Convention."[157] Thus, it is germane to look at the definition of pollution provided for in UNCLOS. In pertinent part, UNCLOS defines "pollution of the marine environment" as:

> [T]he introduction by man, directly or indirectly, of substances or energy into the marine environment . . . which results or is likely to result in such deleterious effects as harm to living resources and marine life . . . hindrance to marine activities, including fishing . . .[158]

Rising ocean temperatures related to climate change could not reasonably be construed as a "substance" under Article 1.1 of UNCLOS. However, the rising ocean temperatures would likely be construed by a dispute resolution body as "energy" because the introduction of heat, such as waste water from production processes, appears to fall under this rubric.[159] Moreover, as developed above, the uptake of anthropogenically-generated carbon dioxide into the oceans can result in direct deleterious impacts on marine life,[160] which clearly brings carbon dioxide under the definition in Article 1.1 of UNCLOS of a polluting "substance" introduced into the ocean.

Where necessary, UNFSA also imposes obligations on the Parties to adopt conservation and management measures for "species belonging to the same ecosystem or associated with or dependent upon target species . . ." and to "protect biodiversity of the marine environment."[161] Moreover, the

155. UNFSA, *supra* note 5, art. 5(d).
156. *Id.* art. 5(f).
157. *Id.* art. 4.
158. UNCLOS, *supra* note 126, art. 1(4).
159. *See* Verheyen, *supra* note 151, at 194-95.
160. *See infra* sec. 2.
161. UNFSA, *supra* note 5, art. 5(g).

Parties are obligated to ensure adequate implementation and enforcement of such measures "through effective monitoring, control and surveillance."[162] Finally, UNFSA requires the Parties to promote and conduct relevant scientific research.[163] In the context of climate change, a coherent research agenda is extremely important to ensure quantification of potential impacts on specific species and to incorporate such impacts into stock assessment processes that are critical for successful long-term management of marine species.[164]

Thus, to the extent that climate change may result in the diminution of certain stocks, or alter their distribution in a way that adversely affects the interests of discrete Parties, a cause of action could arise under the Agreement by which Parties might seek: 1) damages; 2) enforcement of conservation obligations; and 3) a commitment by all Parties to assess the potential impacts of climate change on species regulated under UNFSA..

Rare among international environmental agreements, UNFSA provides for a binding dispute resolution mechanism when efforts to resolve the dispute through non-binding methods, e.g. negotiation, inquiry, mediation or conciliation, have been unavailing. Part VIII of the Agreement applies the dispute resolution mechanism set out in Part XV of UNCLOS to any dispute under the Agreement, even where one or more of the disputants are not Parties to UNCLOS.[165]

As Hafetz observed, UNCLOS "creates a binding system of obligations and dispute resolutions, which confers on a forum international jurisdiction, authority, and implementing powers that exceed those of other international environmental law forums and rival those conferred on the World Trade Organization . . . ."[166] Part XV of UNCLOS provides States with four potential fora for settlement of

162. *Id.* art. 5(l).

163. *See Id.* art. 14(3).

164. *See* Jonathan A. Hare & Kenneth W. Able, *Mechanistic Links Between Climate and Fisheries Along the East Coast of the United States: Explaining Population Outbursts of Atlantic Croaker (Micropogonias undulates)*, 16(1) FISHERIES OCEANOGRAPHY 31, 45 (2007).

165. *See id.* art. 30(1).

166. Jonathan L. Hafetz, *Fostering Protection of the Marine Environmental and Economic Development: Article 131(3) of the Third Law of the Sea Convention*, 15 AM. U. INT'L L. REV. 583, 596 (2000).

disputes:[167] the International Tribunal for the Law of the Sea (ITLOS):[168] the International Court of Justice; an arbitral panel; or a special arbitral panel.[169] States may choose to declare their choice of forum, but in cases where they have not, or Parties to a dispute have not accepted the same procedure for dispute settlement, the dispute must be submitted to binding arbitration unless the Parties agree otherwise.[170] To date, the vast majority of Parties to UNCLOS have, *de facto*, chosen arbitration by their silence on the matter, as have most Parties to UNFSA.[171]

E. Potential Barriers to Causes of Action under UNFSA

A Party to UNFSA pursuing an action based on climate change damages would face some imposing barriers, though none need prove fatal:

1. Causation

As Smith and Shearman observe, "establishing legal causation in climate change actions—that is, proving that a defendant's actions caused the harm suffered by a plaintiff—will pose the greatest obstacle for a majority of plaintiffs."[172] Indeed, causation issues have been raised in two

167. Under UNCLOS's dispute resolution mechanism "[a]ny decision rendered by a court or tribunal having jurisdiction under this section shall be final and shall be complied with by all the parties to the dispute." UNCLOS, *supra* note 126, art. 296(1).

168. *See id.* at Annex VI. The Tribunal is composed of twenty-one judges representing the legal systems of UNCLOS's Parties. *See id.* at Annex VI, arts. 1, 2, 4.

169. *See id.* art. 287(1). Special arbitral panels may be convened for disputes involving "(1) fisheries, (2) protection and preservation of the marine environment, (3) marine scientific research, or (4) navigation, including pollution from vessels and by dumping . . ." *Id.* at Annex VIII, art. 1.

170. *See id.* art. 287(3)-(5).

171. *See* ANDREE KIRCHNER, INTERNATIONAL MARINE ENVIRONMENTAL LAW 22 (2003); United Nations Division for Ocean Affairs and the Law of the Sea, Straddling Stocks Convention, Declarations, *available at* http://www.un.org/Depts/los/convention_agreements/fish_stocks_agreement_declarations.htm (last visited Feb. 16, 2008). The United States has chosen a special arbitral tribunal for, *inter alia*, disputes involving fisheries or marine pollution. *See id.* However, since most Parties to UNFSA have chosen either another option for dispute resolution, or none at all, any dispute involving the United States would likely be settled by an arbitration panel as that is the default when the Parties cannot agree on the same option.

172. JOSEPH SMITH & DAVID SHEARMAN, CLIMATE CHANGE LITIGATION 107 (2006).

international climate cases to date: the Inuit petition to the Inter-American Commission on Human Rights,[173] and the petitions to the World Heritage Committee to list several sites allegedly threatened by climate change on the List of World Heritage in Danger under the World Heritage Convention.[174] Domestic legal systems, and to some extent international law, draw a distinction between general and specific causation. The former refers to the causal link "between an activity and the general outcome," and the latter to the causal link between a specific activity and specific damage.[175] It is likely that both aspects of causation would be raised in an UNFSA climate action.

2. General Causation

In many cases, declining fish stocks or shifts in distribution may be attributable to a number of factors other than, or in conjunction with, climate change, including overfishing,[176] habitat destruction,[177] or diminution of prey

173. In the course of the hearing granted by the Commission in March of 2007, Commissioners Abramovitch and Pinheiro pressed the petitioners as to whether the Commission could attribute State responsibility to the United States for the alleged human rights violations to petitioners given that many other States, including States that were not members of the Organization of the American States, were substantial emitters of greenhouse gases. *See Response to the Commission's Question on Attribution of Responsibility Submitted by Sheila Watt-Cloutier*, Earthjustice and the Center for International Environmental Law, Mar. 2007.

174. *See* United States, Position of the United State [sic] of America on Climate Change with Respect to the World Heritage Convention and World Heritage Sites, *available at* http://www.elaw.org/assets/word/u.s.climate.US%20position%20paper.doc (last visited Sept. 28, 2007). The United States contended, *inter alia*, that "there is not enough data available to distinguish whether climatic changes at the named World Heritage Sites are the result of human-induced climate change or natural variability." *Id.* at 4. For additional information on the petitions, see Erica J. Thorson, *The World Heritage Convention & Climate Change: The Case for a Climate-Change Mitigation Strategy beyond the Kyoto Protocol*, *in* BURNS & OSOFSKY, *supra* note 54.

175. *See* Richard S.J. Tol & Roda Verheyen, *Liability and Compensation for Climate Change Damages – A Legal and Economic Assessment*, Research Unit Sustainability and Global Change, Hamburg University, FNU-9 (2001), http://www.fnu.zmaw.de/fileadmin/fnu-files/publication/working-papers/liability.pdflast visited on Mar. 23, 2008.

176. *See* Samuel F. Herrick, Jr. et al., *Management Application of an Empirical Model of Sardine-Climate Regime Shifts*, 31 MARINE POL'Y 71, 91 (2007); Gian-Reto Walther et al., *Ecological Responses to Recent Climate Change*, 416 NATURE 389, 393 (2002).

177. *See* K.I. Matics, *Measures for Enhancing Marine Fisheries Stock in*

species.[178] As a report to the European Commission recently concluded, "it is extremely difficult to separate, in terms of changes in population densities and recruitment, regional climate effects from direct anthropogenic influences."[179] Thus, a Party to UNFSA defending itself against a claim of damages associated with climate change may contend that it's not possible to link species decline or distribution shifts solely to climatic factors, and thus it cannot be held liable under UNFSA. This argument should not prevail. First, even if other factors may constitute threats to regulated species, clearly, climate change is a substantial peril for many of these species. A tribunal or panel could assess the extent of this threat by employing statistical probability analysis to support a finding of liability where a moving party can establish that climate change results in a "material increase in risk."[180] This approach has been embraced by a number of courts in recent years.[181] This would in turn trigger the obligation of major emitters of greenhouse gases that are

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Southeast Asia, 34(3) OCEAN & COASTAL MGMT. 233-47 (1997).

178. *See* Michel Potier et al., *Forage Fauna in the Diet of Three Large Pelagic Fishes (lancetfish, swordfish and yellowfin tuna) in the Western Equatorial Indian Ocean*, 83(1) FISHERIES RES. 60-72 (2007); Giovanni Bearzi et al., *Prey Depletion Caused by Overfishing and the Decline of Marine Megafauna in Eastern Ionian Sea Coastal Waters (central Mediterranean)*, 127 BIOLOGICAL CONSERVATION 373-82 (2006).

179. INST. FOR ENV'T & SUSTAINABILITY, *supra* note 68, at 21, http://ies.jrc.cec.eu.int/fileadmin/Documentation/Reports/Varie/cc_marine_report_optimized2.pdf (last visited Feb. 16, 2008); *see also* Anna Rindorf & Peter Lewy, *Warm, Windy Winters Drive Cod North and Homing of Spawners Keeps Them There*, 43 J. APPLIED ECOLOGY 445, 445 (2006).

180. *See* Peter A. Stott, D.A. Stone, & M.R. Allen, *Human Contribution to the European Heatwave of 2003*, 432 NATURE 610 (2004). "It is an ill-posed question whether the 2003 heatwave was caused, in a simple deterministic sense, by a modification of the external influences on climate—for example, increasing concentrations of greenhouse gases in the atmosphere—because almost any such weather event might have occurred by chance in an unmodified climate. However, it is possible to estimate by how much human activities may have increased the risk of the occurrence of such a heatwave." *Id.* Peñalver argues that the "but for" analysis employed by many courts to assess causation, reflecting a "deductive nomological" model of scientific explanation, is inappropriate in causal analysis in toxic tort and climate change cases. He advocates a probabilistic theory of causation that reflects the nature of these phenomena. *See* Eduardo M. Peñalver, *Acts of God or Toxic Torts? Applying Tort Principles to the Problem of Climate Change*, 38 NAT. RESOURCES J. 563, 582-85 (1998).

181. *See* Fairchild v. Glenhaven, [2002] UKHL 22 (appeals taken from Austl., Can. and Britain), *available at* http://www.bailii.org/uk/cases/UKHL/2002/22.html.

Parties to UNFSA to adopt measures to reduce these emissions to levels that substantially reduce the threat to high migratory and straddling stock species.[182]

Second, all causation challenges must be considered in light of the regime's precautionary principle provisions. Recognition of the failure of the assimilative capacity paradigm to adequately safeguard the environment led to the formulation of the precautionary principle:

> The precautionary concept advocates a shift away from the primacy of scientific proof and traditional economic analyses that do not account for environmental degradation. Instead, emphasis is placed on: 1) the vulnerability of the environment; 2) the limitations of science to accurately predict threats to the environment, and the measures required to prevent such threats; 3) the availability of alternatives (both methods of production and products) which permit the termination or minimization of inputs into the environment; and 4) the need for long-term, holistic economic considerations, accounting for, among other things, environmental degradation and the costs of waste treatment.[183]

"The precautionary principle can also be viewed as a safeguard against the opportunism of decision-makers in situations of asymmetric information or imperfect monitoring by society."[184] In the context of management and conservation of wildlife species, the principle reflects the recognition that "scientific understanding of ecosystems is complicated by a host of factors, including complex and cascading effects of human activities and uncertainty introduced by naturally chaotic population dynamics."[185]

UNFSA provides that "States shall apply the precautionary approach widely to conservation, management and exploitation of straddling fish stocks and highly

182. *See* UNFSA, *supra* note 5, art. 5(a).

183. *See* Ellen Hey, *The Precautionary Concept in Environmental Policy And Law: Institutionalizing Caution*, 4 GEO. INT'L ENVTL. L. REV. 303, 307 (1992).

184. YLVA ARVIDSSON, IIIEE REPORTS THE PRECAUTIONARY PRINCIPLE: EXPERIENCES FROM IMPLEMENTATION INTO SWEDISH LAW, 11 (2001), *available at* http://www.iiiee.lu.se/information/library/publications/reports/2001/Ylva-Arvidsson.pdf.

185. Robert J. Wilder, *Precautionary Principle; Prevention Rather Than Cure*, OCEAN 98. http://www.wildershares.com/pdf/Ocean98.Nature%20article.Wilder.pdf (last visited Feb.l 16, 2008).

migratory fish stocks in order to protect the living marine resources and preserve the marine environment."[186] Thus, even under scenarios of uncertainty about a given threat, such as climate change impacts, Article 6 of UNFSA provides "[t]he absence of adequate scientific information shall not be used as a reason for postponing or failing to take conservation and management measures."[187] As Colburn observes, "[t]he precautionary approach essentially reverses the process of marine scientific research (MSR) application in the management of straddling and highly migratory fish stocks, allowing states and RFOs to proceed with conservation measures even in the absence of scientific certainty."[188] Thus, in the context of potential threats posed by climate change to fish species regulated under UNFSA, it can be argued that the Parties have an obligation to take action even in the absence of definitive proof of causation.

3. Specific Causation

The targeted Party in a climate-related UNFSA action might argue that climate change is caused by a multitude of anthropogenic sources, and thus, any specific harm cannot be attributable to a specific Party, even a large greenhouse emitting State such as the United States or China. The issue of specific causation would be most germane in cases where a moving Party seeks damages.[189] A Party to UNFSA might not seek monetary damages in pressing a climate change case against another Party. Rather a Party bringing such an action might be exclusively, or in the alternative, seeking a commitment by the targeted Party to fulfill its "duty to cooperate" under the treaty[190] by enacting effective measures to contribute to the goal of "long-term sustainability of straddling fish stocks and highly migratory fish stocks . . ."[191]

Under the terms of UNFSA, as well as customary international law, all treaty obligations must be fulfilled in

186. *Id.* art. 6(1).
187. *Id.* art. 6(2).
188. Colburn, *supra* note 8, at 347.
189. *See* Verheyen, *supra* note 1591, at 248.
190. *See* UNFSA, *supra* note 5, art. 5.
190. *See id.* art. 6(1).
191. *Id.* art. 5(a).

good faith, the principle of *pacta sunt servanda*.[192] The obligation of good faith, which Henkin has correctly characterized as "the most important principle of international law,"[193] imposes a duty upon treaty Parties to exercise their sovereign rights in a manner that is consistent with their treaty obligations.[194] Moreover, the failure to fulfill treaty obligations in good faith constitutes a breach of treaty obligations and entails international responsibility.[195] Furthermore, a finding of a breach of a treaty obligation would not require the establishment of specific causation:

> It is important to note that injury or material damage is not a prerequisite for the existence of a wrongful act, i.e. for the invocation of State responsibility . . . Thus, while a claimant State must, under the [Draft Articles on State Responsibility], show a causal relationship between the activity and the damage caused to be eligible for reparations . . . the State can, without showing a causal relationship demand, as long as breach of an international obligation has taken place. This is in line with customary law . . .[196]

Thus, any UNFSA Party failing to make a good faith effort to address its anthropogenic emissions of greenhouse gases, given their potential impact on fish species, could be found to be in violation of the treaty even in the absence of establishment of specific causation. This breach, in turn, would impose an obligation on the breaching Party to cease its wrongful conduct,[197] which in this context would require a

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192. *See id.* art. 34; Vienna Convention on the Law of Treaties, May 23, 1969, 1155 U.N.T.S 331, art. 26; I.I. Lukashuk, *The Principle of 'Pacta Sunt Servanda' and the Nature of Obligation Under International Law*, 83 AM. J. INT'L L. 513, 513 (1989).

193. LOUIS HENKIN, CONSTITUTIONALISM, DEMOCRACY, AND FOREIGN AFFAIRS 62 (1990).

194. *See* Declaration on Principles of International Law Concerning Friendly Relations and Co-operation among States in Accordance with the Charter of the United Nations, G.A. Res. 2625, U.N. Doc. A/8082 (Oct. 24, 1970), Preamble; Final Act of the Conference on Security and Cooperation in Europe, Aug. 1, 1975, at art. 10, 73 DEP'T ST. BULL. 323 (1975).

195. *See* Duncan Currie, *Whales, Sustainability and International Environmental Governance*, 16 REV. EUR. COMMUNITY & INT'L ENVTL. L. 45, 53 (2007); *see also Draft Articles on Responsibility of States for Internationally Wrongful Acts, Report of the Int'l Law Comm'n on the Work of its Fifty-third Session*, U.N. GAOR, 56th Sess., Supp No. 10, art. 2, U.N. Doc A/56/10 (2001).

196. VERHEYEN, *supra* note 151, at 243.

197. *See Draft Articles on Responsibility*, *supra* note 195, art. 30.

Party to reduce its emissions below a threshold that would substantially decrease the risks to interests protected under UNFSA.

Moreover, even in cases where a Party might seek damages under UNFSA, the fact that other States may contribute to climate change need not prove fatal to such an action. As Verheyen notes, "[t]hat a contribution to the legally relevant outcome can be sufficient to establish causation is accepted in many jurisdictions around the world . . . ."[198] This includes under the U.S. Restatement of Torts, which provides that "a conduct or event question is a cause in fact of the harm if it is a substantial factor in producing it,"[199] as well as under German law, which holds a person responsible for an increase in risk that manifests in damages.[200] Moreover, the International Law Commission has held that a State can be held liable for reparations in cases where it has played a "decisive" role in causing an injury.[201]

F. Reluctance of Dispute Resolution Bodies to Address Climate Change

Experience with climate change litigation to date in the United States, at least, has demonstrated some reluctance on the part of members of the judiciary to address climate change issues given their limited scientific expertise. Consider, for example, Justice Scalia's flippant but telling comment during the recent Supreme Court oral arguments in *Massachusetts et al. v. Environmental Protection Agency*:[202]

> JUSTICE SCALIA: . . . your assertion is that after the pollutant leaves the air and goes up into the stratosphere it is contributing to global warming.
>
> MR. MILKEY: Respectfully, Your Honor, it is not the stratosphere. It's the troposphere.

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198. VERHEYEN, *supra* note 151, at 255.

199. RESTATEMENT (SECOND) OF TORTS §431 COMMENT A (1965).

200. *See* VERHEYEN, *supra* note 151, at 255.

201. *See* Gaetano Arangio-Ruiz, *2nd Report on State Responsibility*, [1989] 2 Y.B. Int'l L. Comm'n 14, U.N. Doc. A/CN.4/426.

202. No. 05-1120, U.S. Supreme Court, Oral Argument, Nov. 29, 2006, *available at* http://www.supremecourtus.gov/oral_arguments/argument_transcripts/05-1120.pdf.

> JUSTICE SCALIA: Troposphere, whatever. I told you before I'm not a scientist.
>
> (Laughter.)
>
> JUSTICE SCALIA: That's why I don't want to have to deal with global warming, to tell you the truth.[203]

Parties bringing an action before ITLOS or an arbitral panel might experience similar reservations on the part of the dispute resolution body to grapple with the complicated technical issues associated with climate change, especially since the primary area of expertise of tribunal or panel members may be more traditional fisheries issues, such as the impact of harvesting on species. UNFSA provides two mechanisms to help address this concern. First, in cases where "a dispute concerns a matter of a technical nature," the States involved in a dispute may refer the dispute to an "ad hoc expert panel," which will confer with the Parties and seek to resolve the dispute without recourse to binding procedures.[204] A Party seeking to press a climate change claim could certainly seek to engage another Party in such negotiations initially, and should this fail to resolve the dispute, seek to introduce the panel's scientific findings in a binding dispute resolution forum. Additionally, if both Parties agree to it, cases of this nature can be referred to a "special arbitral panel."[205] Under UNCLOS's dispute resolution provisions in this context, which UNFSA fully incorporates,[206] a panel hearing a climate change-related dispute could be constituted by experts in the fields of fisheries, marine environmental protection, marine scientific research, drawn from the FAO, the United Nations Environment Program and the Intergovernmental Oceanographic Commission,[207] all of whom have expertise on the nexus of fisheries and climate change. Of course, as indicated above, this provision of UNFSA can only be invoked with the consent of both parties. Thus, there is a very good chance that a party against which a climate action would be brought would refuse, believing that ITLOS or an arbitral

203. *Id.* at 23.
204. *See* UNFSA, *supra* note 5, art. 29.
205. *See supra* note 169 and accompanying text.
206. *See supra* note 165 and accompanying text.
207. *See* UNCLOS, *supra* note 126, at Annex VIII, art. 2(1)(2).

panel might be far less likely to grapple with complicated science associated with such a case.

Perhaps an even more imposing barrier to a cause of action under UNFSA may be the perceived threat to the legitimacy of a dispute resolution body should it enter a decision against a hegemonic State and that State should choose to either ignore the decision or drag its feet. As Strauss observes, international tribunals carefully marshal their political capital in an effort to preserve and enhance their legitimacy:

> While the official function of international tribunals is to find the pre-existing law; in reality, for judges to have their decisions so accepted, they must engage in the creative process of negotiating the differing global interests to formulate results that are in accord with the international community's normative center of gravity. In arriving at politically viable legal standards, in addition to formally reviewing submitted briefs and memoranda and informally reading other legal commentary, judges engaged in a pragmatic assessment of the political situation, by factoring in the relative power of the protagonists and the interests of other important international actors.[208]

The primary threat to the legitimacy of a UNFSA dispute resolution body in the context of climate change may be that a powerful State would choose to not comply with the decision given the dramatic policy changes that it might necessitate. As Silk recently observed, States may choose to not comply with "binding" decisions when they deem it against their interests:

> In international law, even allegedly binding dispute settlement mechanisms such as arbitration may be ignored when a state disagrees with the decision. To illustrate, in the Beagle Channel dispute between Chile and Argentina, Argentina challenged the validity of the arbitrators' decision on dubious grounds and, despite the implausibility of Argentina's repudiation, the decision was never enforced . . . . Under UNCLOS, there might be strong domestic and international pressures to sign a

208. *See* Andrew Strauss, *Toward an International Law of Climate Change: Utilizing a Model of International Tribunals as Law-Makers*, *in* BURNS & OSOFSKY, *supra* note 54.

> fishery agreement regardless of the costs of compliance, but when the time for compliance comes, narrower national interests may prevail.[209]

Indeed, the fear that decisions against the United States might be ignored may explain the recent decisions of the Inter-American Commission on Human Rights and World Heritage Committee to reject petitions to address climate change.[210]

II. CONCLUSION

In a perfect world, the threat of climate change would be effectively addressed through the international institutional responses developed in the 1990s. Unfortunately, the specter of climate change looms larger now than it did a decade ago, and the prospects for adequate responses within the UNFCCC framework appear increasingly remote. Now more than ever, those most vulnerable to the impacts of climate change must explore alternatives that may finally galvanize the major greenhouse emitting States into action. UNFSA is one option that deserves further exploration.

209. *See* Richard J. Silk, Jr., *Nonbinding Dispute Resolution Processes in Fisheries Conflicts: Fish Out of Water?*, 16 OHIO ST. J. ON DISP. RESOL. 791, 800-01 (2001).

210. *See supra* notes 3-4 and accompanying text.

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